COMMITTEE WORKSHOP

BEFORE THE

CALIFORNIA ENERGY RESOURCES CONSERVATION

AND DEVELOPMENT COMMISSION

In the Matter of:)	
)	
Preparation of the 2007)	Docket No.
Integrated Energy Policy)	06-IEP-1N
Report (2007 IEPR))	
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VOLUME II

CALIFORNIA ENERGY COMMISSION

HEARING ROOM A

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

THURSDAY, JUNE 28, 2007

9:00 A.M.

Reported by:
John Cota
Contract No. 150-04-002

COMMISSIONERS PRESENT

Jackalyne Pfannenstiel, Presiding Member

James D. Boyd

Jeffrey L. Byron

John L. Geesman, Associate Member

ADVISORS PRESENT

Susan Brown

Tim Tutt

STAFF and CONTRACTORS PRESENT

Barbara Byron

Mike Gazzolo

Steven C. McClary, MRW & Associates, Inc.

Robert B. Weisenmiller, PhD, MRW & Associates, Inc.

Lorraine White

ALSO PRESENT

William B. Jones, United States Nuclear Regulatory Commission

Samson Lee, PhD, United States Nuclear Regulatory Commission

Steven M. Olea, Arizona Corporation Commission

John S. Keenan, Pacific Gas and Electric Company

Gary L. Schoonyan, Southern California Edison

David A. Lochbaum, Union of Concerned Scientists

ALSO PRESENT

Rochelle Becker, Alliance for Nuclear Responsibility

Richard Cheston, Unites States Government Accountability Office

Jim Harding, Harding Consulting

Vasilis Fthenakis, PhD, Brookhaven National Laboratory

Mary M. Quillian, Nuclear Energy Institute

Joe C. Turnage, PhD, Constellation Generation Group

Thomas B. Cochran, PhD, Natural Resources Defense Council

Lloyd Cluff, Pacific Gas and Electric Company

Doug McNea

Bob Woehl, Electric Power Research Institute

Ken Schrader, North American Young Generation in Nuclear

Kristin Zaitz, North American Young Generation in Nuclear

Robert F. Williams, Advocates for Clean Responsible Energy and Williams Technical Associates, Inc.

Edwin D. Sayre, Advocates for Clean Responsible Energy

Tom McClean, Fresno Nuclear Energy Group, LLC

John Hutson, Fresno Nuclear Energy Group, LLC

Bruce Marlow, AREVA

Bryce Johnson

Steffen Kammler, City Solar AG

I N D E X

I N D E X

P R O C E E D I N G S

9:05 a.m.

PRESIDING MEMBER PFANNENSTIEL: Good morning, this is a workshop with the Integrated Energy Policy Report Committee and other Commissioners from the California Energy Commission. I'm Jackie Pfannenstiel, the Chair of the Energy Commission and the Presiding Commissioner on the Integrated Energy Policy Report Committee. To my left is Commissioner John Geesman who is also on the Integrated Energy Policy Report Committee. To his left is Commissioner Jeff Byron. To my right is Commissioner Jim Boyd and to his right is his advisor Susan Brown.

With that we have a day of very important and, I believe, very useful to us, information. We will use the information gathered from this workshop as fodder for our information in the IEPR Report on nuclear power.

This is the second day of a workshop on nuclear power. We covered a lot of ground on Monday and as I think everybody in this room understands there's a lot more ground yet to be covered. And we'll get as far as we can today.

So why don't I turn it over to Lorraine.

MS. WHITE: Good morning, thank you Chairman. My name is Lorraine White. I am the program manager for the Integrated Energy Policy Report proceeding for 2004, or pardon me, 2007 (laughter).

Just a throw back, sorry. Today is the second day of our Nuclear Workshops. There is so much material associated with this subject it was necessary for us to spread it out over a two day period. So we will begin.

Just a few logistical announcements, information about our facilities for those of you that are joining us for the first time.

Out the double-doors and to the left you will find restrooms. You will also find another set of restrooms behind our elevators.

For those of you seeking refreshments throughout the day there is a snack shop on the second floor under the awning.

In the event of an emergency please follow staff out the doors. There's two exits, one to our right here out the double-doors, which most of you probably came in, and then one to the left.

We will be reconvening across the street at the park. And wait until you get the high sign from staff that it would be safe to return before you come back in the building.

The Integrated Energy Policy Report proceeding is the Energy Commission's key activity that is developed every two years to produce a report outlying key issues facing the state related to energy resources.

It also is dependent on input from various parties. Your participation is key to the development of this report and its findings as well as policy recommendations.

To facilitate your participation not only with you joining us in person we have also accommodated remote participation in the form of a call-in number 1-800-857-6618. The pass code is IEPR. I'm the call leader.

And for those that would love to follow along the presentations and view the slides and hear the audio only you can do so on our webcast service which is found on the Energy Commission's website www.energy.ca.gov.

For those of you who are here in person we ask that if you have questions or comments that you please fill out a blue card. We'll be collecting those and providing them to the Chairman who will calling up people as appropriate.

We will also be having opportunities for questions of panelists and things like that throughout the day.

As I said this is the second day of a two day workshop. The first we covered an overview of our consultant report, The Status of Nuclear Power in California.

We also discussed issues related to spent fuel storage and disposal programs. The Federal Reprocessing Program and as part of our second we're going to be delving into the operational issues associated with the current fleet of plants and their associated environmental, safety and economic implications.

As I mentioned earlier we're seeking public input as we go through this material in order for us to develop the final status report and any appropriate information that will feed into the Integrated Energy Policy Report.

To give you some context about what is required in this particular proceeding we are tasked with assessing and forecasting supply, demand and price to meet the needs of California. As part of this, of course, nuclear generation is a key component.

We also are looking at ways of improving efficiency both in lighting and through land use.

We're looking at advanced technologies, in particular we're focussing on what's happening with coal.

And then we're looking at issues associated with the cost of generation.

We're developing and we'll be recommending various policies to address the issues identified in this proceeding.

And as I have mentioned we are obtaining information from not only market participants but other stakeholders in the process. We're consulting with our sister agencies at the federal, state and local levels.

Our schedule for this proceeding is to adopt an Integrated Energy Policy Report on or about October 24th so that we may transmit it to the Governor and the Legislature by the statutory deadline of November 1st.

The information about this proceeding

and today's workshop is, in fact, found on our website. If you would like to ask any kind of questions about the general proceeding I welcome you to contact me. My information is also on the Energy Commission's website and also in the notice that's available out front.

On nuclear power issues I would like you to direct your comments or questions to our Senior Policy Analyst Barbara Byron. She will be speaking in just a moment to give a greater context about nuclear issues in particular for our proceeding. And her contact information is also on the Energy Commission's website and in our notice.

So if there are no questions I'd like to pass it off to Barbara.

MS. BYRON: Thank you. My name is Barbara Byron and I'm the Energy Commission's Senior Nuclear Policy Advisor. I'd like to welcome all of you to the workshops today especially thanking our panel of experts for their efforts to travel here to Sacramento and put together their presentations for the Commissioners today.

I also wanted to mention that all of the panelists' presentations are posted on our website. And transcripts from these workshops will also be posted on our website.

Before we get started I'd like to provide you with a brief context for these workshops. As we heard on Monday California relies on three nuclear power plants for about 13 percent of California's electricity supply. And these plants are accumulating spent nuclear fuel on-site.

The California Energy Commission's role with respect to nuclear power includes that Commissioner Jim Boyd is the Governor's appointed state liaison officer to the US Nuclear Regulatory Commission. In addition Commissioner Boyd and I represent California on Transportation Advisory Boards to the Western Governors Association and the Western Interstate Energy Board. And we coordinate California's comments on key federal documents related to the Yucca Mountain repository.

Two issues of concern for California have been the potential groundwater and transportation impacts in California from the repository.

As Commissioner Boyd indicated on Monday, we're concerned about some of the roads in California being used for federal waste, nuclear waste shipments to and from facilities in Nevada.

The Energy Commission over the past several years has urged DOE in its Environmental Impact Review of the Yucca Mountain Project to evaluate route-specific impacts in California from proposed shipments.

California's nuclear waste laws, which were passed in 1976, prohibit land use for new nuclear power plant construction in California until the California Energy Commission makes findings that the authorized federal agency has approved and there exists a demonstrated technology or means for the disposal permanently of these high-level wastes and for reprocessing spent fuel.

The Energy Commission evaluated the status of waste disposal and reprocessing technologies in 1978 and concluded that no operational and approved federal waste disposal options existed.

This finding was reaffirmed in the Energy Commission's 2005 Integrated Energy Policy

Report to the Governor and Legislature as well as in a comprehensive consultant report, Nuclear Power in California: Status Report. Copies of that report are available outside.

In 2005 the Energy Commission conducted public workshops on nuclear power issues and we contracted with our consultant MRW and Associates to provide a status report on nuclear power in California.

The Energy Commission provided recommendations to the Legislature and Governor on nuclear issues as part of the 2005 Integrated Energy Policy Report.

MRW and Associates has updated their Nuclear Issues Status Report and we provided a copy of this report online for public review. We're asking for comments on this draft report by July 13th.

Future California Energy Commission activities on nuclear issues will include preparing the AB 1632 Nuclear Assessment Report Assemblyman Blakeslee's bill that was signed by the Governor in 2006 requires the Energy Commission to report to the Legislature in 2008 on the vulnerability of large plants to seismic events and plant aging, costs of accumulating at reactors and assess policy and planning issues that will affect the future role of nuclear power in California.

We also will be coordinating and preparing California's comments on draft federal environmental impact statements for the Yucca Mountain Project. And we will finalize the California status report on nuclear power and make recommendations and findings in the 2005 Integrated Energy Policy Report.

And last we will also continue working with western state and national groups on federal nuclear waste transport policy development and planning. And now it's my pleasure to introduce the Energy Commission's consultant on nuclear power issues Dr. Robert Weisenmiller and Steve McClary.

They're with MRW & Associates. And I'd like to thank them and their staff, particularly Laura Norin and Heather Mehta, for their help in preparing the draft report and organizing this workshop. And we look forward to today's workshop. Thank you.

MR. McCLARY: Good morning, my name is

Steve McClary with MRW & Associates and I think this morning we will dive right in if we may. The focus this morning is on the state's operating plants, how they're performing and, to some degree, the future plans for those.

The state does rely on three nuclear plants for a key part of its resource base, Diablo Canyon owned by PG&E, the SONGS plant with majority ownership and operation from Southern California Edison and the Palo Verde plant in Arizona operated by Arizona Public Service but with substantial ownership by California utilities.

We'll hear from representatives or those concerned with all three of those plants this morning. They are regulated by the Nuclear Regulatory Commission. And we have representatives from NRC here today.

To start I'd like to say we have a couple of changes to the agenda as posted. The first is that our first speaker Kevin Crowley of the National Academies was to join us by audio conference from Japan. Unfortunately accumulation of the time difference and his travel plans frustrated our attempts to do that. And we thank

Kevin for making a heroic attempt. We also thank the staff for making a heroic attempt to bring an international call to us this morning. Unfortunately that's just not going to be able work.

From the Nuclear Regulatory Commission the agenda did not identify speakers at the time it was originally posted. But we do have two representatives, one of whom, Bill Jones, is actually caught in Dallas, I believe it is, by the rain in Texas. If you've been following what's been going on down there. So he'll be joining us by conference call. His colleague Samson Lee is with us this morning and will lead off.

So just to lead into that, Bill Jones who I believe is on the line and is able to join us.

MR. JONES: That would be correct.

MR. McCLARY: Mr. Jones is serving as the Acting Deputy Director in the Division of Reactor Safety in the Region IV Office for the Nuclear Regulatory Commission.

Since beginning his career with the NRC he has held progressively more responsible positions including Resident Inspector, Senior

Project Engineer, Senior Resident Inspector, Senior Reactor Analyst and as a Chief in a Reactors Project Branch.

He holds a Bachelor of Science Degree in Nuclear Science from Virginia Tech. He was able to join us two years ago when we addressed these issues originally and we welcome him back. He'll be joined by Mr. Samson Lee who is here with us in the room.

Mr. Lee is the Acting Deputy Director for the Division of License Renewal, which is obviously a key issue as well for our plants. That division is responsible for the review of nuclear power plant license renewal applications. Mr. Lee has been with the NRC for about 20 years and has a PhD in Mechanical Engineering from MIT. And we're very glad he could join us today. Thank you again.

Mr. Jones if you'd like to lead off I will get your slides up and running and you can give the signal as needed.

MR. JONES: Okay, thank you very much. As I was introduced this is Bill Jones. I'm with the Region IV Office in Arlington, Texas. Currently serving as the Acting Deputy Director in the Division of Reactor Safety. With me today is Mr. Samson Lee the Acting Deputy Director, Division Director for License Renewal.

Again, I'd like to thank the California Energy Commission and the individuals that put this together for giving us the opportunity to talk before you. I realize the importance of this workshop and we're very glad to be able to participate in it.

The NRC is the federal agency with responsibility to license and regulate the nation's civilian use of (inaudible) materials to insure adequate protection of public health and safety, (inaudible) assure the protection of the environment.

We accomplish this through the implementation of the NRC's independent licensing and inspection process. As a result of that we are the agency that oversees commercial use of nuclear power and license those from commercial facilities.

Sam and I are both pleased to be with you and we will be providing an overview of the Nuclear Regulatory Commission's activities for this Integrated Energy Policy Report workshop.

The NRC is involved in some litigation in the areas that were identified as part of the workshop scope. I think we may be limited (inaudible) questions but we will try to answer to the best of our ability in each of those areas.

First Sam will be providing an overview of the NRC's license extension process for power reactors. But right there I'd like to turn it over to Mr. Samson Lee. Sam.

DR. LEE: Thank you very much Bill. Yeah, I'm going to talk about license renewal, power plant license renewal process. Can I have slide two please.

The Atomic Energy Act authorized the NRC to issue a 40 year license. And it also allows for license renewal.

And the NRC has performed extensive research and has held public workshops to regulate plant aging. And it concluded that the adequate management of the effects of aging of the equipment can maintain plant safety as plants age.

The license renewal rule is focused on managing the aging effects of the plant equipment.

The NRC is also responsible under the Plant National Energy Policy Act to consider environmental impacts.

So far the NRC has granted renewal licenses for additional 20 years for about half of the operating reactors. Can I have slide three please.

The license renewal will consist of two parallel paths. License safety review, this is on the aging of the equipment and the management of, and the environmental review which is to determine the environmental impacts.

Can I have slide four please. License renewal again is focused on managing the aging effects of plant equipment for license renewal. And the current regulatory requirements and oversight continue.

For example, emergency planning, security and plant performance those are subject to current requirements and that will continue.

If issues come up in these areas today the NRC will deal with them now and NRC will not wait for license renewal. And I also want to add that there are now two petitions for rulemaking in front of NRC to consider the impact of tourism on spent fuel pool.

They've been filed by the California and

Massachusetts Attorney Generals. For the Massachusetts petition the public comment period has closed. And for the California petition the public comment period will close in July.

The NRC will evaluate these petitions and the public comments. Can I have slide five please.

This is a simplified diagram of the license renewal process. The top portion shows the safety review and also shows an independent review by the Advisory Committee on behalf of the safeguards.

The lower portion of the curve shows the environmental review and the dashed lines shows that if a hearing had been granted the Atomic Safety and Licensing Board will conduct hearings. Can I have slide six please.

This shows the license renewal principles. The first principle is that the current regulatory process is adequate to ensure plant safety.

The second principle is that the plant's current licensing basis, that is the regulatory requirements and any commitments, will continue during license renewal with the added requirement for aging management which is the focus for the license renewal rules. Slide seven please.

For the safety review the staff will review the application and we also audit on-site documentation that supports the application. The staff documents the result of the review in the safety evaluation report.

And also NRC staff will conduct on-site license renewal inspections. Separate from the staff's review the Advisory Committee on Reactor Safeguards conduct their own independent review.

This committee is actually specified in the Atomic Energy Act and it consists of a panel of experts and they report directly to the Commission. Can I have slide eight please.

This shows the environmental review. As far as the environmental review the NRC staff will hold meetings with the public to gather the comments on the environmental issues related to the plant.

And the NRC staff will also consider information from federal and state agencies. And we document our results in the Environmental Impact Statement. As I choose to be specific, we are completing a generic environmental impact statement. We will prepare a plant-specific supplement to the generic environmental impact statement. Can I have slide nine please.

This shows some typical milestones. And it shows the opportunity for hearings. It shows the environmental, safety and independent review schedules, typical schedules. Can I have slide ten please.

This shows the opportunity for public involvement. We try to have a very open license renewal process to the public. And these opportunities are also open to the state and local government.

These are lists of meetings that the public can participate, observe and provide comment. In addition, for the State of New Jersey they also observe NRC license renewal inspections through a memorandum of understanding with the NRC.

And regarding the experience in license renewal hearings, the public, including state and local governments, that raise an issue in license renewal applications. However most of these issues are outside the scope of license renewal, such as emergency planning and security.

Regarding once-through cooling system for the Vermont Yankee Plant. The public had raised an environmental issue relating to the impact of thermal discharge of the once-through cooling system.

And the Commission had determined -- has decided to defer this issue to the state because the state issues the national pollutant discharge elimination system permit through the Clean Water Act.

The first case that is starting on a hearing relates to the issue of aging management of the containment structure at the Oyster Creek Plant. That'll be the first. Can I have slide 11 please.

The Commission makes a decision based on the staff's review and the advice from the Advisory Committee on the other safeguards and the results of the hearing if a hearing is conducted.

Although NRC has a 40 year issue with new licenses this is only one of the conditions for the plant to continue to operate beyond year 40. For example, a utility may need state permits for the national pollutant discharge elimination system and coastal zone management.

In addition the state would have to decide whether it is economical to operate beyond year 40. And the Commission schedule is typically 22 months if there's no hearing granted and 30 months if there's hearings conducted. And that concludes my presentation.

MR. JONES: Okay, thank you Sam. I'll go ahead and proceed with my areas of discussion and then Sam and I will take questions from the Commission.

Again, this is Bill Jones. The areas that I will be addressing are just to provide the workshop with an update on California plants, San Onofre Nuclear Generating Station and the Diablo Canyon Power Plant as well as the Palo Verde Nuclear Generating Station.

Some discussion of the design basis threat, which was a vitiated rule in March of this year.

Discussion of high-level waste, our activities in that area.

Just a brief discussion on the Global Nuclear Energy Partnership. Where we stand relative to that. And a brief overview of new reactors from an organizational -- the operating life of the, the bottom line process.

The NRC's reactor oversight process as it relates to the two facilities in California and Palo Verde is actually the same process that is used nationwide. It's referred to as our reactor oversight process.

In 2005 when I had the opportunity to talk before the Commission also I went into more detail into our oversight process. I'd be glad to do so but in respect to time I will just touch on those aspects that reflect on the performance of the two California plants and Palo Verde.

The NRC conducts independent inspections of all the nation's commercial nuclear power plants. The NRC has resident inspectors at each of the licensed facilities, 104 power plants. These individuals are responsible for the day-to-day inspection activities at that facility. These individuals live in the area and are part of the community around each of these plants.

In addition these inspectors are assisted by regional inspectors with different specialties including emergency preparedness, security and engineering disciplines, to form what we refer to as the baseline inspection program.

This baseline inspection program is at each of our licensed facilities.

The NRC has provided a process where the inspection findings are available on the Internet under the worldwide web.nrc.gov. Part of this process is the NRC assessment of the licensee's performance.

Information that is used in that overall assessment process is also available on the worldwide web at nrc.gov. So the public has access to the same information the NRC is using to make its regulatory decisions. How we classify the performance on each of the nation's power plants.

The NRC performs an assessment of, an assessment at each of these licensees during the end-of-cycle review and also during the mid-cycle. And then on a continuing basis as needed during the year.

This overall process is described in our inspection manual chapter 0305. And that document is also available publicly on the NRC website. It's referred to as the Operating Reactor Assessment Program.

With regard to Diablo Canyon, the NRC

conducted independent inspection activity and as a result of those inspection activities the NRC found that Pacific Gas and Electric had operated Diablo Canyon in a manner that protected the health and safety of the public and was assessed to be performing in the licensee response column of the NRC's regulatory action matrix.

This level of assessment provides that the NRC will perform our baseline inspection program, which as I indicated is performed at each of the nation's power plants.

Previously the NRC had identified a cross-cutting theme involving human performance for the adequacy of design documentation and procedures. Based on our latest assessment the NRC has assessed that this cross-cutting theme does not exist at the Diablo Canyon Power Plant.

In addition the licensee is planning steam generator replacement for both units 1 and 2. Unit 2 is scheduled for 2008 and unit 1 scheduled for 2009.

NRC will conduct inspection activities specific to the steam generator replacement to ensure the integrity of the steam generators and reactor cooling system and we will provide the results of that inspection in our inspection report which will be available (inaudible).

In regard to the Diablo Canyon independent fuel, spent fuel storage facility. The NRC issued a material license in 2004 for 20 years. The NRC inspectors observed the construction of the ISFSI pad.

During this period a petition was provided to the US Court of Appeals, the Ninth Circuit Court of Appeals, to have the NRC consider acts of terrorism in the environmental review.

The Ninth Circuit Court of Appeals did find that the NRC cannot categorically refuse to consider consequences under the National Environmental Policy Act and remanded the case to the NRC.

The Commission issued a memorandum and order in February of this year directing the staff to prepare a revised environmental assessment for the likelihood and consequences of terrorism activity or a terrorist act.

The NRC has completed this draft environmental assessment and came up with a finding of no significant impact were referred to as a finding.

This document or this draft policy is currently open with public comment closing on July the 2nd of this year.

The results of the NRC's review in this draft environmental assessment was that the staff found the construction, operation and decommissioning of the Diablo Canyon ISFSI, even when potential terrorist activities on the facility are considered, would not result in a significant affect upon the environment.

with regard to the San Onofre Generating Station the NRC staff found based on our independent inspections and assessments that Southern California Edison operated the San Onofre Generating Station in a manner that preserved public health and safety and protected the environment.

The licensee was assessed to be in the licensee's response column of our action matrix. And this again provides for the baseline inspection program as provided for each of the nation's power plants.

In addition the NRC will provide inspection of the plant's steam generator replacement scheduled for 2009 and 2010 on units 2 and 3 respectively.

With regards to Palo Verde Units 1, 2 and 3. Palo Verde unit 1 and 2 were both operated in a manner that preserved the public health and safety and met the cornerstone objectives with moderate degradation and safety performance.

Unit 3 was operated in a manner that preserved the public health and safety and the cornerstone objectives were met. However the performance was then what is referred to as the multiple repetitive degraded cornerstone. And these terms are more definitively defined in the manual chapter, inspection manual chapter 0305, operating reactor assessment program.

Since the finding and the assessment was that the performance was in the multiple repetitive degraded cornerstone, the cornerstone areas I should point out essentially lie in three different areas of reactor safety, radiation safety and safeguards. And in this case the specific cornerstone that was affected was the mitigating systems.

As the NRC found that the licensee was in the multiple degraded or repetitive degraded cornerstone we will be implementing what is referred to as our supplemental inspection process. Specifically we will be implementing inspection procedure 95003. This is essentially a diagnostic review of the licensee's performance relative to unit 3.

However because many of these performance aspects that resulted in unit 3 being at this degraded cornerstone, multiple degraded cornerstone, are (inaudible) to inspect Units 1 and 2, those units will also be included.

The NRC staff has conducted a public interest on the 95003 inspection activities near the site. Typically this inspection is to perform an independent diagnostic review of the program processes used by Palo Verde to operate the plant and to determine the extent of safety, organizational and programmatic issues.

The focus areas will include whether Palo Verde can identify, evaluate and correct performance issues, the adequacy of the Palo Verde Program and processes to operate and maintain the units, the causes and corrective actions for the two performance deficiencies, the yellow and white findings on unit 3 which resulted in being in the multiple repetitive degraded cornerstone, and establishing a site safety culture.

I'd like to point out that the site safety culture is a very important aspect of the NRC's review as part of our 95003 inspection process. And that we have actually --

Following our meeting with the licensee in the area of the facility as part of our interest to this section activity The NRC has issued a confirmatory action letter to Arizona Public Service that specifically identifies five areas for their action.

Within these five areas there were additional sub-activities but I would like to at least provide an overview of those five areas.

The first is to complete actions to address the root causes and contributing causes identified in their evaluation in response to the yellow findings associated with the boiler containment subsection for all three units, and the white findings associated with the unit 3 (inaudible) generator electrical relay problem.

The second area is to complete corrective action that will result in sustained, improved performance in the cross-cutting areas of human performance and problem identification resolution. And inevitably it identifies specific action (inaudible).

To complete an independent, third-party, safety culture assessment by September 15, 2007. As I indicated the NRC inspection team has already begun our reviews in this area.

The fourth area is to incorporate the results of their in-depth evaluation and of their safety culture assessment prescribed per the third-party review. And to submit the portions of a modified improvement plan that impacts the reactor safety strategic performance area, including the safety culture improvement initiative by November 30th of this year.

The NRC also held a town hall meeting in the local area around the plant to gain insight and to inform the residents and other interested individuals of the overall activities of the NRC and its involvement in Palo Verde.

Once the 95003 inspection is completed the NRC will issue a modification to the confirmatory action letter that I just referred to, to identify any additional or modify any actions that we've identified.

Now the NRC understands that all the

problems will not have been completed, corrective action completed by the time we complete our inspection to be associated with the 95003 inspection activity. However we do fully expect to see that the licensee's improvement plan is being implemented and that those actions are shown to be effective.

A reasonable question would be what if the licensee does not continue to show improvement in this area? And although the licensee is currently within the multiple degraded cornerstone there are additional actions the NRC can take as prescribed in the action matrix in the manual chapter 0305, which includes the unacceptable performance column.

An unacceptable performance represents situations in which the NRC lacks reasonable assurance that the licensee can or will conduct its activities to ensure protection of the public health and safety.

And such examples would include multiple, significant violations of the facility's license and technical specifications, regulations or orders, loss of confidence in the licensee's ability to maintain and operate the facility in accordance with the design basis.

Now a pattern of failure of licensee management controls to effectively address previous significant concerns to prevent the reoccurrence ordered sometime during the next -- we're going to process the licensee were to find that they also should not be or choose to shut the facility down.

The NRC does have a section, manual chapter 030, excuse me, 350 process which describes the NRC's activities associated with a plant that is in a shut down condition. This includes regular meetings of the NRC's senior management officials to overview the licensee's activities prior to restarting again at the facility.

With that I'd like to move on to the design basis threat. In March of this year the NRC issued the design basis threat rule under 10 CFR part 73 which looked at the advisory, adversary characteristics and the ability of a private security force to defend against those actions.

Part of the design basis threat review involved the 12 points that were identified in the

Energy Act of 2005. And in the NRC's Federal Register Volume 72, number 52, shown on pages 12705, each of those 12 points is specifically discussed.

The NRC did make the modification changes to the design basis threat but largely it reflects the orders that the NRC had put out following the September 11 attack on the country, which includes areas such as additions to the security plans, training qualifications and continued the actions, as well as coordination with local, state and federal enforcement agencies.

From an overall standpoint the security at the nation's nuclear power plants, although it was substantial prior to September 11, has further been strengthened through the orders that have been issued as well as the actions or activities associated with the design basis threat of rule (inaudible).

Also I'd also like to point out that the NRC has been involved in looking at activities, terrorist attacks along nuclear facilities which included loss of large areas and the mitigating strategies associated with that. These factors have been incorporated into the rule.

In addition, although the rules do not specifically address the independent spent fuel storage facilities, those facilities are covered under the orders that had previously been issued and as such the requirements for those facilities are also (inaudible).

Moving on I'd like to briefly talk about the High-level Waste Policy Act. In 1982 the US policy act on high-level waste was issued. And the act covered several areas in that the high-level radioactive waste to be disposed of in the underground in a deep geological repository. It identified Yucca Mountain, Nevada as the single candidate site.

The Department of Energy was identified with the responsibility for developing the repository. And EPA was responsible for developing the environmental standard for this repository. The NRC then is responsible for developing the regulations to implement the EPA's safety standards and for licensing this repository.

As I indicated the NRC has the statutory and licensing role as amended under the Policy Act of 1982. The main responsibilities include to serve as an independent regulator with oversight responsibilities for Yucca Mountain, to set the licensing criteria consistent with the US Environmental Protection Agency's standards for Yucca Mountain, to complete the safety review of the Department of Energy license application, to make a construction authorization decision on the Department of Energy's license application in three to four years, and to adopt the environmental impact statement prepared by DOE for Yucca Mountain to the extent practical.

And also we have been working to develop and maintain the licensing support network and to also performing the formal nuclear hearings in regard to Department of Energy licenses.

It's important that the NRC has not received an application from the Department of Energy. The current timeline for that submission as we understand it is June of 2008. With that there will of course be the required review and hearings associated with that before any decision is made as to whether or not to license Yucca Mountain.

With regard to the current storage

capacity. If Yucca Mountain were to be licensed, essentially my understanding, it could cover the current waste for the US facilities. And any changes in US policy on high-level wastes, including reprocessing, would affect that overall capacity. But as I did indicate the NRC has not received an application from the Department of Energy although we have indications that we may get it in June of 2008.

With regard to the Global Nuclear Energy Partnership. This is the Department of Energy's profit-developed systems. Technologies and policy regimes to allow recycling of used light-water reactor fuel and eliminate the -- (inaudible) fast burner reactors. Overall we understand it like it's a consolidated fuel treatment system, an advanced burner reactor and advanced fuel cycle fuel facility.

Commissioner Lyons provided a speech on this topic in June of this year and it is publicly available. Overall the NRC has not determined what stage our involvement would be in this Global Nuclear Energy Partnership. But the improvised framework would be essentially to -- our activities could possibly include the framework, guidance, the training of qualified staff and inspection activities.

In addition we're also looking at how the National Environmental Policy Act would fit into the Global Nuclear Energy Partnership.

Next I'd like to address the new reactors. The NRC -- The Energy Policy Act of 2005, this act authorized for federal risk insurance for the next six nuclear plants for delays associated with NRC reviews. I believe it's on the order of 500 million for the first two and then 250 million for the next four.

Nuclear, it also provided for nuclear energy production credits for the first 6,000 megawatt electrics for advanced reactors and authorized approximately $3 billion in nuclear research and development to support the next generation nuclear plant and Department of Energy's Nuclear Power 2010 Program.

The NRC has been actively involved for the last several years in providing a new reactor organization. This is located in our headquarters office, as well as providing for construction staff and development of procedures in our Region II Office.

These organizations are in place. Mr. (inaudible) at the NRC has provided updated standard review plans and is finalizing the 10 CFR Part 52, which is the rule that would provide for early site permitting, design certification and the combined license.

The NRC has been working to improve the overall licensing process. And this is available also on site, excuse me, on our website. But it looked at a design-centered review approach. It raises the NRC issue that a regulatory information summary 2007/08 which discusses our design-centered review approach as a one-issue, one-review, one-petition approach.

In addition the NRC has provided design certification for four reactors. We're looking at six early site permanent applications and possibly 19 combined license applications.

10 CFR 52 license rule provides for the enhancement of the design certification early site permit and the combined license process.

Overall on our public website the NRC does provide an overall timeline for the combined license review including the preliminary activities associated with the early site permitting, the activities associated with the design reviews and also the combined license.

And in addition the NRC is currently developing what is referred to as the ITAACs. These are the inspection task analysis acceptance criteria which will be part of the overall certification of the construction of a facility and for verification that the plant was built as provided.

With that the NRC does have some additional discussions, talking points on new reactors. And as I indicated these -- the process, the timeline and in many cases the applications that are pending are provided on our website at nrc.gov.

With that I'd like to conclude my discussion and provide for any questions or answers that we can.

MR. McCLARY: Thank you Bill.

PRESIDING MEMBER PFANNENSTIEL: Thank you Mr. Jones and Mr. Lee. Very content full. Questions from the dais? Commissioner Boyd.

COMMISSIONER BOYD: Again, thank you Mr. Jones and thank you for again in two years of testifying to our Commission. And Mr. Lee thank you for your presentation. I have three areas I want to cover.

First will be Palo Verde. And I want to thank you for your detailed discussion of the current situation there. It's complex both in terms of the language we use in this business and the citations to all the various codes and chapters and what have you.

I just want to make a comment on this. Of course as the State Liaison Officer for California I've been following this rather closely. And the events of the last couple of weeks which you did detail, I appreciate that, I just want to indicate to you and to folks here that in simple terms the NRC moved Palo Verde, particularly unit 3 from, what we say, column 4, from column 3 to column 4. There's only one column left. And that becomes as discussed, unacceptable performance and possible shut down.

It's unclear to me whether this potential shut down of unit 3 or the whole facility. And I know there's a long process and we're talking about many months into the future.

But unless indicated, for the first time in the roughly five years I've been doing this I contacted the management of the California Independent System Operator to just suggest that if they hadn't put this incident on their watch list, which they had not although they were aware of it, that they probably should because here in California we worry about who's providing our electricity supply present and future. And shut down of one unit or shut down of the whole facility would be a rather significant event.

So, while this is not meant to imply there is an impending problem it's just meant to inform our management here that we're being cautious and thinking into the future. So I thank you for being very complete in your discussion of the fact that we do have an issue there that hopefully will get better but it is an issue of concern.

Secondly on SONGS, there has been a recent incident. And I might not have brought it up except this morning while watching the morning news, more interested in what's happening up at my beloved Lake Tahoe than anything else, there was a banner headline across the, or I guess a footline across the TV screen talking about the recent SONGS incident and of course the cryptic language of instant media was not very descriptive and could lead the public to be a little concerned. I wonder if you might want to mention what's going on at SONGS.

MR. JONES: Certainly. As you indicated there was an event at SONGS Unit 2 that involved a loss of non-safety related air system. Essentially a pipe associated with the air system failed. This resulted in a loss of air to a regulating valve that was feeding the or providing the control for feed water to the big generator.

The licensee manually tripped the reactor because of the loss of (inaudible) to a safe condition. As a result of that event the NRC has, as part of our inspection process, I described the baseline section, we referred to the supplemental inspection process which will remain at Palo Verde.

In addition we have a reactive process that we looked at. We performed a review of that event to determine that we would be conducting a special inspection at SONGS which is currently underway. That special inspection will be completed within likely the next week or so. And from that the NRC will be issuing an inspection report which will be put onto our public website and available to all to look at.

It is an area of concern to us. We did determine that the event was of a nature that we did want to perform a special inspection. We have initiated that inspection. In addition the charter, the scope of the activities the inspectors will be involved in is available through our (inaudible) and that can also be found at our website. Thank you for bringing that up.

COMMISSIONER BOYD: Thank you. And my last question is either to you or Mr. Lee. Mr. Lee referenced aging management or aging deficiencies as we talk about the relicensing of, potential relicensing of existing plants. And I just want to ask kind of general question about your experience since in this country in the last few years we've hit the 40 year line for several plants and there have been relicensing activities. And undoubtedly California's plants are getting near the end of their license lifetime.

I'm wondering in this area of aging of components at facilities if you or your agency is observing aging to be somewhat of a linear thing. That is things just get old over time so to speak.

Or are you finding aging to be variable depending upon individual components? Or are you finding no consistency in what you see as aging of facilities from plant to plant or from similar types of equipment to similar types of equipment or manufacturer to manufacturer?

DR. LEE: Yeah, Bill, I can try to answer that. What we have seen so far is that that is not, aging is not unique to license renewal. So you have corrosion, you know, pretty much, so you're kind of seeing that. So it's not really unique.

For license renewal, for the age of management what we have seen so far is a lot of plants, they put in more inspections programs or more maintenance programs. They might commit to more replacement, more analysis. So it's not really unique. But now they have to be more careful. They need to, you know, keep an eye on it.

COMMISSIONER BOYD: Okay, thank you, That's all.

PRESIDING MEMBER PFANNENSTIEL: Yes, Commissioner Byron had a question. Commissioner Geesman.

ASSOCIATE MEMBER GEESMAN: I too want to thank Mr. Jones and Dr. Lee for being here today. I think that it greatly contributes to our efforts to have a better understanding of the subject area.

I have two general areas of inquiry to Dr. Lee. You mentioned in your comments and I believe you may have been speaking of the Oyster Creek proceeding but you mentioned that your commission would defer to the state in the NPDES permit. Did I get that correct?

DR. LEE: That's correct. That is on the Vermont Yankee case.

COMMISSIONER BYRON: And on a more generic basis, meaning all of the plants that you see, would it be your intention to defer to the states in the NPDES permit issuing process?

DR. LEE: Actually if you read the Vermont Yankee the decision, the Commission actually made it very clear that they would actually defer.

ASSOCIATE MEMBER GEESMAN: My reading of the Riverkeeper Circuit Court decision would indicate that, if in fact there is a conflict between the safety requirements of the NRC and the environmental requirements of the NPDES permit that the NRC's concerns would, in fact, prevail under those circumstances. So I wonder if you could elaborate how you envision this deferral process working.

DR. LEE: The deferral, the way I see it is that this deferral relates to the environmental impact. For safety there is a certain safety requirement that the plant needs to meet. By meeting the safety requirement but if it cannot meet the environmental impact like the, the charge permit then they can not operate.

ASSOCIATE MEMBER GEESMAN: So would it be correct for me to conclude that a state has a pretty free range of discretion in its NPDES decision making as long as it does not come into conflict with one of your safety requirements.

DR. LEE: It depends. They might be different because the safety requirements is to operate safely you need to meet this requirement. But if you cannot get a state permit to operate in that way you just can not operate. We do not want an unsafe plant.

ASSOCIATE MEMBER GEESMAN: And do you envision these decisions or determinations being made on a plant-by-plant basis or would you envision a more generic rulemaking process at the NRC.

DR. LEE: I think this is in the existing rules. If you read the Vermont Yankee the decision. That's how the Commission is interpreting the existing rule.

ASSOCIATE MEMBER GEESMAN: Thank you. The second area that I wanted to inquire of you relates to how your process intersects or overlaps with the Institute of Nuclear Power Operation, INPO. We were referred earlier this week in the workshop that we held by Dr. Charles Ferguson in our discussions of how we might create a better international safety culture or level of confidence in the safe operations of nuclear plants around the world. Professor Ferguson suggested INPO as a good model to develop that confidence. And I wonder in your process what intersection or overlap may exist with the INPO process.

MR. JONES: Well.

DR. LEE: Yeah, Bill, you can talk about that.

MR. JONES: This is Bill Jones again.

The NRC has a memorandum of understanding with INPO as to how we will conduct our activities. The NRC, of course, our inspection activities looks at many of those activities that INPO is also.

We do not directly follow INPO findings. We don't necessarily follow up on those activities. But we are aware of the type of issues that are being identified. And to look at it from the perspective of what type of issues does the INPO evaluation for example of a facility provide any other insight that we may not have.

We do consider that. Resident inspectors are typically the point of contact for that interface. In addition the, we don't follow up specifically on the INPO findings but we do make sure that we have an understanding of what they're (inaudible).

In addition INPO has data available on equipment performance and we do have access to that through an agreement. That we can use then for insight in inspections but we don't necessarily refer to that specifically. You will not or should not see specific references to INPO documents in any of our inspections. We did utilize some of that information in our planning and moving forward.

The relationship has evolved over time where licensees, excuse me, INPO does in-plant evaluations. We don't get involved directly with -- For example if they were looking at a surveillance activity we would not look specifically at that surveillance and allow them to operate independently. And they do the same for us is we're looking at specific surveillance situations for example.

But we do understand and communicate what the understanding the INPO findings, what the significance of what they're looking at actually is. But as I indicated there is a memorandum of understanding. And the relationship has evolved over time and has proven to be very effective in that it does provide an independent review of these licensees and we are provided with that the information and the overall assessment. Does that answer your question?

ASSOCIATE MEMBER GEESMAN: Yes it does. I guess if I could follow up with a somewhat more general one. What would be your advice to a state regulator in terms of trying to establish a level of confidence in either existing plants or the prospect for license extensions in the actual INPO results.

MR. JONES: That would have to be -- From a state regulator that would have to be an agreement that you would have to talk to with INPO itself. However, such as the state of Illinois does have their own inspectors and we have a memorandum of understanding where we share information. They actually on occasion participate in recovery inspection activities. And those are agreements that have previously we've worked out. And if the state of California was interested in doing such a thing we'd have to look at working out that type of agreement.

ASSOCIATE MEMBER GEESMAN: Thank you very much Mr. Jones.

PRESIDING MEMBER PFANNENSTIEL: Commissioner Byron.

COMMISSIONER BYRON: Thank you both for being with us today. Dr. Lee I was wondering if you could answer a few questions for me with regards to license renewal of our nuclear generating capacity that we rely on. I'm not sure exactly, I think Diablo Canyon and SONGS are in the vintage of about 25 years old right now. I think Palo Verde is obviously a little newer. Have you had any indication at this point for or have you received applications for license renewal from any of these nine units?

DR. LEE: We have not received an application and they have not expressed an interest to NRC.

COMMISSIONER BYRON: Okay. Do I have it about right on the dates, about 25 years old. Well I suppose we can get into these with the operators as well.

DR. LEE: I think that's about right.

COMMISSIONER BYRON: You had indicated about half of the operating reactors have received license renewal, have been granted extensions.

DR. LEE: That is correct.

COMMISSIONER BYRON: Have any license renewal applications been denied at this point?

DR. LEE: We have not denied an application, however we have returned one application because of the quality. And we also delayed the review of one application because of the support.

COMMISSIONER BYRON: Because of --

DR. LEE: Inadequate support on the applicant.

COMMISSIONER BYRON: And can you tell me typically when you grant a license renewal extension or a license extension are there any operating and maintenance requirements that are imposed on the plants that might affect output or its ability to be dispatched?

DR. LEE: The additional requirements are on age management programs so they'll commit to more inspections, more analysis. But I haven't seen anything that affects the output of the plant.

COMMISSIONER BYRON: Okay, thank you.

PRESIDING MEMBER PFANNENSTIEL: Again I want to express our appreciation for both members of the NRC to be here and help us on this difficult issue. Why doing I turn it back to Mr. McClary and see where we're going here.

MR. JONES: This is Bill Jones I would again like to express our appreciation for being allowed to participate in this process from our standpoint also. And also for you making the accommodations to allow me to participate by phone after my attempts to get to Sacramento yesterday, the cancellation of my flight at 11:30 last night. Your staff worked very well with me and I do deeply appreciate it.

The NRC is involved in a lot of activities, as you're well aware of. But from the Chairman, the Commission, the senior management and the NRC staff, although we're involved in new reactors and activities and development of those organizations, the staff's focus remains on assuring safe operation of the nation's nuclear reactors. And that includes San Onofre, Diablo Canyon and Palo Verde. I see that day to day in our discussions that the Chairman has with the staff and meetings we have with the Commission. And if our staff's performance are being the basis (inaudible).

Again I appreciate the opportunity to talk with you and I just wanted to let you know we do take our job very seriously, working hard to ensure the safe operation of those plants or take action a is necessary to ensure that they're operating safely or not at all. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Well again thank you Mr. Jones, especially for your extra efforts to participate. It's very important to us here. You're critical partners with us in this evaluation.

COMMISSIONER BOYD: Mr. Jones, this is Commissioner Boyd. Please give my regards to Bill Maier of your staff there who's been a good, excellent liaison with us here in the state of California.

MR. McCLARY: Well thank you and with that we'll return to individual plants, focus there and we'll start off with Palo Verde. We have with us today Mr. Steven Olea. He's the Assistant Director of the Utilities Division at the Arizona Corporation Commission.

He's been with the Commission since 1983 and Assistant Director of the Utilities Division since 2000, represents the Commission on several task forces and commission regional agencies. And we're very glad to have him with us today to talk about Palo Verde.

MR. OLEA: Yes, good morning Chairman and Commissioners. Again, I'm Steve Olea of the Arizona Corporation Commission staff. And I'm one of two assistant directors there in the Utilities Division. And I'd like to thank you for inviting me to be part of this workshop today.

And let me get my glasses on to see what slide is up for me. And if we could just go to the third slide when you get there. The second slide is just my disclaimer that I do work as part of the staff there. And the Arizona Corporation Commission is made of five statewide elected officials. And in my capacity here today I am not speaking for them. So any opinions you hear today are mine and not those of the commissioners or the staff.

In particular with the Palo Verde Nuclear Generating Station it's made up of three units. Units 1 and 2 currently have a capacity of about 1,410 megawatts gross and 1,340 net. And Unit 3 is at its original capacity of 1,300 megawatts gross and about 1,225 net. And those are approximate numbers.

And the reason for the differences is that on Units 1 and 2 they already have had their steam generators replaced and Unit 3 is going to have its steam generators replaced this fall. So it will have an extended outage this fall. They are estimating about 100 days to get all that done.

Currently Unit 1 is down for a planned

refueling outage. And that's, currently the refueling outage is without the steam generator replacements. But going at about 39 or 40 days and there about 20 to 25 days into that outage right now. And units 2 and 3 are operational at this point.

And as was discussed by Mr. Bill Jones, currently at Palo Verde Units 1 and 2 are on what's called column three of the NRC action matrix and that's due to a degraded cornerstone.

Unit 3 is in column four of that action matrix. And as was mentioned by Commissioner Boyd, there's only five columns. So there's only one more left to go. And they don't want to get into column five.

But the reason they're in column four, as was stated, is because of the multiple repetitive degraded cornerstones.

And currently, and there's a large part of my presentation that you've already heard from Mr. Jones, but there's a piece of mine that gets into a little bit more detail.

Currently the NRC has taken action and they have initiated their inspection procedure 95003. They also have assigned an additional on-site inspector at Palo Verde because of this.

And they are conducting quarterly public meetings. And one was already done this last month. And they're going to do these meetings because with all of the publicity and all that has taken place with moving Unit 3 into column four they want to make sure that the public stays informed as to exactly what's going on out there.

On June 21st the NRC issued what's called a Confirmatory Action Letter. And I'll get into details of that letter in a minute.

And even though it's only Unit 3 that's in column four the entire site is being evaluated. And that's because all three units are identical. And you have the same upper management for all three units. So if you've got some kind of site culture that's going on in one of those units it's probably going for all three units. So that's why the whole site is being evaluated by NRC.

In the, and if we can go to the Confirmatory Action Letter. There are five points that are in that letter. And the first one has to do with the site, addressing the root and contributing causes for the four items that are listed.

And that is that in the NRC's eyes at Palo Verde there was ineffective resolution of emerging technical issues, there was failure to routinely question validity of engineering assumptions for operability of the equipment, there was inconsistent notifying of the operations, of operation personnel of the operability concerns, and there was inadequate performance monitoring in measures to fully assess corrective action effectiveness. And those are the four pieces and that one point that the management and the employees at Palo Verde have to address in order to get out of that column four.

The next point is they have to complete corrective actions to improve human performance and problem identification resolution.

And there's the three areas that are specific for that point there. And again, there was a question in something that was sent to me by Barbara Byron that at this workshop one of the questions was going to be was there anything that we learned as far as what's happened at Palo Verde and how they got into column four.

And in my mind one of the primary things we learned is that the employees and management at a nuclear station can not get complacent. Five or six years ago the Palo Verde Nuclear Generating Station was probably the top performing plant in the country. And today they're the worst as far as, there's only one other plant in column four.

And a lot of that has to do and this is from the meetings I've attended not only with the NRC but with the Arizona Public Services that management and the employees out there sort of became complacent. And they knew they were at the top and they kind of thought they were always going to stay there just by and I guess just because they were there.

And we've learned that you can't stay at the top without working hard at it. And that's why they're in column four today.

The last three points that were in the letter from the NRC was as was mentioned earlier was that they have to complete an independent safety culture assessment by September 15th.

And that is one where I believe the NRC based on the meetings I've attended and also the management of Arizona Public Service felt that the employees out there were again getting complacent. And that the safety culture was going in the wrong direction.

And everybody out there, all the employees have to question everything that goes on and make sure that everything is being done properly. And if there's anything they see that's not they have to bring it to the attention of management and if that's not good enough they bring it to the attention of NRC.

And so that's why the management of Palo Verde has to do this assessment to make sure that all of the employees out there have that attitude and have that questioning attitude.

Now they also have to incorporate the results of an in-depth evaluation and a safety culture assessment into a modified improvement plan. And they have to submit the modified improvement plan that would impact reactor safety by November 30th of this year.

Now what is Arizona Corporation Commission doing with. At this point the Commission is monitoring the plant's compliance with the NRC to make sure they are doing everything they have to do to get out of column four and to do everything that the NRC is going to ask them and also require them to do.

And also the Commission staff is evaluating the 2006 outages at Palo Verde. And that is because the Arizona Corporation Commission is the one that sets rates for all of the utilities in the state. And they want to make sure that any outages that occurred at Palo Verde were not the results of imprudence because if they were the result of imprudence then those costs that would be shared by Arizona Public Service which is the one utility that owns a part of Palo Verde that the ACC regulates those costs would not be passed on to ratepayers.

And there was a recent Arizona Public Service rate case that just concluded, in fact it's still in the, it's not final yet because there's a because after the Commission signs the order there's a period of 20 days where that order can be appealed. And we're still in that appeal period.

But in that order Arizona Public Service was ordered to work with Commission staff to draft a nuclear performance standard for that station that would be used by the Corporation Commission in future cases.

Now there's nothing in the order that

says that the Commission would actually adopt that standard. And that's because the Commission is very concerned that they not do anything that would interfere with the Nuclear Regulatory Commission. But they at least want to see what staff and the management of Palo Verde can come up with that maybe the Commission could use in future cases.

And the following slides, there's a set of slides and they are very brief summary of a very detailed presentation that management at Palo Verde presented at the public meeting that I was talking about. And this was on June 6th. And it was in an old town called Tonopah which is about 50 miles west of Phoenix which is right where the plant is located.

That slide presentation that was put together by the management of Palo Verde was probably about 100 different slides. And it was a very detailed explanation of exactly the steps that Arizona Public Service as the operator of the station was doing to comply with what the NRC was going to require them to do, all of the assessments to get out of column four.

And I'll just briefly go through these.

And they have labelled this the Impact Project. And the purpose of the project is to improve the site safety culture. And as I mentioned earlier that's critical to all this. Is that everybody at that site, every employee has the same attitude with regard to safety. That it's not just a few people in the control room that have that attitude but everybody has that attitude.

And they also have to identify issues and corrective actions to enable Palo Verde to improve performance. And they have to sustain that performance for the long term.

And the assessments that they have to do here are the independent safety culture assessment as I said. They have to identify broad-base safety, organizational performance issues. They have to review programs associated with identifying and assessing corrective performance deficiencies. Perform an assessment of selected performance deficiencies and associate organizational issues. They have to determine if actions related to the recirculation actuation sump have been effective. And that one and the next issue that have to do with the emergency diesel generator. These last two bullet points, those are the bullet points where they had the problems that got them into column four. So the have to assess what's happening there and what caused that.

And they have a collective evaluation they have to identify the primary areas that are driving performance deficiencies at Palo Verde. And they have to establish improvement actions to achieve sustained high performance for the long term.

And again, all that boils down to the attitude of each employee and exactly what they're doing and if they have that questioning attitude and I've heard that term used by NRC at several of the meetings that all the employees have to have that questioning attitude as to and they can't have the attitude well that' the way you know that's the way we've done it for the last four years so it must be right. And that's not the case because that's part of the reason that they're in column four.

And the results of all of this have to be that the corrective actions to prevent recurrence of issue that caused Palo Verde's decline in performance. And for example they have to address the organizational, the processes and equipment and the cultures at the plant.

They have to have an integrated plant to support and strengthen safety culture. They have to sustain performance improvement for the long term.

This next slide is a diagram of exactly the process that the management at Palo Verde is going to go through to get at least part way of getting them out of column four. In the meetings I've that attended the questions we're asked is of the NRC and of the management at Palo Verde was how long was it going to take to get out of column four?

And the answer was a long time. And that meant maybe three years, maybe two, maybe four but somewhere around the three year period is what they're expecting.

And there's no hard and set time frame. But there has to be improvement that keeps being shown. And I think that was mentioned by Mr. Bill Jones. Is that at the end of this 95003 is that they don't expect, well, they know that Palo Verde won't have done everything it has to do to get out of column four.

But they at least have to see that they're starting to move in the right direction. And that's what they expect to be seeing by the end of the year. So this long diagram was talked about at the management at Palo Verde in Tonopah and it was a very detailed explanation of exactly what they have to do to get to where they want to be at least by the end of the year.

And the last slide has to do with this is how the management of Palo Verde is looking at what they have to do. And in one of the meetings I went to with the NRC the three boxes that the NRC was most concerned with, okay, and it's obviously safety, but to get to the safe operation is that there's the plant equipment, there's the corrective action and the human performance.

Those were the three that the NRC felt that the management at Palo Verde really had to focus on. And there was one of the statements that Dr. Bruce Mallet has made at several of the meetings for NRC is that he kept stressing that none of the units, 1, 2 or 3, none of those units was ever operated in an unsafe manner.

But the reason that Unit 3 is column four is because of everything that did happen.

NRC wanted to make sure that it never got to the point where they were operating in an unsafe manner.

And from everything I've heard at all the meetings is that everybody expects Palo Verde to get out of column four back into column three, two and one. They expect that.

But I think as was mentioned, and again by Commissioner Boyd,is that everybody has to be cautious. But there's nothing that's eminent that's about to happen that would be negative of Palo Verde. But that doesn't mean that people shouldn't be cautious and do everything they can do to get Palo Verde out of column four and back up into line into the other columns.

And that's the end of my presentation and I hope it was helpful to what you're doing here today.

PRESIDING MEMBER PFANNENSTIEL: Extremely helpful, thank you. Questions?

COMMISSIONER BOYD: Only a comment that you kind of confirmed my feeling that the recent action by NRC was a very significant and close shot across the bow to the operators of that unit to the need to get their act together. So I, like you, hope that they turn it around and get it corrected.

And there's no question that we as a species can get very complacent sometimes about where we are. So good luck to you as a state agency with oversight for that.

PRESIDING MEMBER PFANNENSTIEL: Commissioner Geesman.

ASSOCIATE MEMBER GEESMAN: Yeah I want to thank you for your presentation. What weight does the Arizona Commission give to the INPO rating for Palo Verde?

MR. OLEA: Well, okay, that's hard to say and I know that it was considered. But in the APS rate case it wasn't a major portion of the rate case. But they did ask about it.

ASSOCIATE MEMBER GEESMAN: How good --

MR. OLEA: -- you know in that.

ASSOCIATE MEMBER GEESMAN: How good of predictive indicator if the rating of future problems at the plant?

MR. OLEA: Well, and again, this would just be my opinion. But I guess not very good because before this they were at a one rating and now they're in column four of the NRC action matrix.

And I think they were and I think the Palo Verde Station was rated number one by INPO for, okay I'm going to say close to 10 years.

And I think that's part of what got into the complacency attitude out there is that they were always at the top of the INPO rating. And things kind of slipped away after that.

ASSOCIATE MEMBER GEESMAN: Is that rating something that is accessible to your staff and something that you monitor?

MR. OLEA: Not something that we monitor, no.

ASSOCIATE MEMBER GEESMAN: But it is accessible to you?

MR. OLEA: I'm going to have to say I don't know because I know that was an issue. Because I think the rating is accessible. But the reasons that they get a certain rating were not accessible.

ASSOCIATE MEMBER GEESMAN: So if you saw the rating begin to decline and obviously there's pretty significant financial consequences when these plants don't operate as well as they are hoped to but as you saw the rating decline you wouldn't have the ability to penetrate the rating and determine what it was that was causing that?

MR. OLEA: To be honest with you I don't know. And I know that our legal division had, there was legal questions there. So I don't know the answer to that one.

ASSOCIATE MEMBER GEESMAN: Thank you.

PRESIDING MEMBER PFANNENSTIEL: My question is similar but I'm just wondering whether there's any, in retrospect, whether there's any sort of early warning that you could have tracked. When did you realize that there was significant problems at Palo Verde. And is there some guidance you can give us on what we should be looking for.

MR. OLEA: Well for the Commission staff, we don't have anybody on the staff that knows how to operate a plant or that has that kind of experience so what we rely on a lot is on the NRC. And we get, in fact I do, I get copies of everything that's issued by the NRC for that plant.

And so when we see something coming from the NRC that shows that they're having questions or they're having concerns that's when we have those same concerns. And we try to work with the NRC and with the management at Palo Verde to keep track of what's going on.

But we follow mostly the NRC and not INPO.

PRESIDING MEMBER PFANNENSTIEL: Thanks. Anything else? Thank you very much for being here.

MR. McCLARY: Okay, we'll now turn to Diablo Canyon and PG&E. And our next panelist is Jack Keenan who's Senior Vice-President for Generation and Chief Nuclear Officer for Pacific Gas and Electric.

And in that capacity he oversees generation overall not just nuclear but also specifically the operations of the nuclear reactor at Diablo Canyon. He is relatively recent with PG&E but has been in the generation, and specifically, the nuclear generation part of utility operations throughout his career on the east coast with Northeast Utilities and Progress Energy.

MR. KEENAN: Thank you, good morning.

PRESIDING MEMBER PFANNENSTIEL: Good morning.

MR. KEENAN: I'm pleased that you invited me here to discuss PG&E's Diablo Canyon. And I look forward to having an interchange with folks and I hope to be very educational.

We have sent previously a paper answering the Commission's workshop questions so I will not be covering all those questions during my presentation. First slide please.

This is a picture of Diablo Canyon. That's on 12,500 acres of beautiful coastline here in California.

It supplies a large part of our electric supply to our customers which I'll talk more about. But it's basically a base-loaded and we run as often as we can. And it's a low-cost supplier at this point.

Diablo Canyon has very minimal impacts to the environment in this area as I think you can probably see. And we continue to monitor that. And it does emit no greenhouse gases in the generation of its electricity.

The other important fact is that we do have decommissioning funds available to return that venue to its original condition as the surrounding areas are in.

A little bit of data about Diablo Canyon would be that it's a Westinghouse pressurized water reactor, pretty standard in the industry of those built at the time.

It did start commercial operations as referred to earlier in the mid 80's for both Unit 1 and Unit 2. And you can see that we produce over 2,000 megawatts of clean power for California which satisfies almost a quarter of our customers' needs at PG&E.

And it represents approximately 10 percent of native California generation at that site.

We were licensed by the NRC to operate for 40 from the dates that you see above.

And also PG&E has a very rich history in the, early on in terms of nuclear power operations with receiving the first Atomic Energy Commission license number one in 1957 at Vallecitos and then '63 we licensed Humboldt Bay and, of course, Diablo Canyon.

For PG&E and Diablo Canyon safety is a core value. Our number one responsibility is the public health and safety. We take that very seriously.

One of the ways we do that is through our emergency planning. We have an extensive emergency planning effort ongoing. It obviously meets all NRC requirements. In addition we work very closely with many agencies.

We regularly train with those agencies, have drills and exercises which are critiqued. And from those critiques we usually have considerable amount of lessons learned that we continue to go back and take corrective actions to correct.

And we continuously upgrade our facilities to become more modern and have all the latest equipment in order to be prepared for an emergency.

Plant security is certainly another way that we ensure the safety of the public. We have a very, very, well-trained and highly skilled armed force at Diablo. We're very proud of those individuals. And we have significant equipment at the site both active and passive to prevent any type of terrorist attack or undetected individuals coming to our area.

If you've had an opportunity or can get an opportunity to visit Diablo Canyon I think you'd see what I'm talking about. We are certainly the most well-defended industry in the United States.

We have a significant long-term seismic program. We have some of the most distinguished individuals in this area that understand the geosciences of the earth and to continually monitor what's the latest what's going on with the Earth and around us and around the whole world actually to understand and update our seismic situations in California.

And our commitment to safety we're very committed to the safety of our workers. It goes down to many levels. I wanted to show you in this graph the type of safety that we have within our workers at Diablo Canyon. We've continued to improve the safe work conditions and the safety culture of people who work at Diablo Canyon and that includes not just our employees but of people that come as contractors to work there.

You can see this trend and I know it sometimes these rates are hard to understand. But we basically recently have reached the level of .05 and that would be an injury rate of lost-time accidents per 200,000 hours.

And to give you an example of what that might mean better to understand is that if a 100 employees worked for 20 years we'd have one lost-time accident with that rate.

Looking at it from a scale compared to some other industries that rate for our industry is actually at .25 overall for nuclear power plants. And that compares to electric utilities the work that they do to about two. And the manufacturing sector at about 3.6.

And I think you'll see later in the presentation this is 2004 statistics that the latest statistic have actually shown that the nuclear industry has improved down to about .12. So it's even getting better than this.

So it's basically one the very, very safest industries in the world to work in. It's comparable, if not better, than working on Wall Street or in real estate (laughter).

Talk a little bit about the environmental benefits. Obviously I mentioned that Diablo Canyon is carbon-free in our generation. And we're very proud of that at PG&E. And, in fact, our generation portfolio is 90 percent carbon-free. Obviously with the other major generations being hydro.

Our overall portfolio even given the electricity we purchase for our customers we're over 50 percent carbon-free.

So the nuclear plant itself if we had to replace that actually with generation today would have to be probably gas generation and it would produce eight to ten million tons of carbon dioxide annually.

So we believe that Diablo is critical and nuclear power is critical to meeting the goals that California has.

On used fuel, I'm not going to speak too much on that. I know you're having other presentations and have had other presentations and on used fuel. But I just want to say that used fuel is really not a technical issue.

The storage and transportation of used fuel has been, the technical issues have been solved. We can store it safely. And it's been transported throughout the world and through the United States safely without injury to anybody. It's a proven technology.

And seawater cooling we have been using that a long time as other people have. It's thoroughly studied and understood. We continue to monitor our affects on the environment. They are minimal.

And, in fact, if we had to use other cooling methods we would find that the impact to the environment would probably be greater.

And as I mentioned earlier we're fully funded to restore the site to what we call a greenfield so that you would not know that it was there at the end of its lifetime.

In mentioning the used fuel, we have at Diablo Canyon you can see on the right a picture of a spent-fuel pool, one of the spent-fuel pools at Diablo. Obviously again as I mentioned it's safe and secure in the pool. We've been storing fuel like that for in commercial power plants for in the 50 year range.

We consider these systems temporary though because the DOE is committed to take the fuel. Obviously that's another issue that you're looking at a lot harder then. So I won't go into that.

But we believe that we obviously have prepared to ship fuel when the DOE is ready to accept it. You can see in the lower picture, and

I did want to mention that the capacity of our pools is about 75 percent. And that is all the fuel that Diablo Canyon has made in over 20 years. So it's all in one pool and certainly is a small amount of fuel given the amount of power that has been generated.

You can see in the lower picture the dry-storage facility which is going to be complete in early '08. It is, that is a picture of it there. It's well on its way to being complete. It's a robust design. The industry has been using this for over 20 years. And we feel very comfortable that that will be very safe storage of our fuel based on the experience and design of those casks. And again they can be shipped to the DOE when they're ready to receive the fuel.

One of the things that obviously this is a very controversial spent-fuel is probably the most controversial issue when it comes to nuclear power. I personally feel that nuclear power since we have spent-fuel is in some ways a very positive because the fuel that we use to generate electricity we still have it. It's in our hands. We can deal with it. When you use fossil fuels the by-products are end up spread across our environment, clearly cause damage to the environment and have proven to cause human suffering.

This right here we can deal with it, store it safely and I know you're going to talk, you have talked probably about reprocessing. That's certainly a good option to reuse the fuel.

Talk a little bit about Diablo Canyon and our performance. We've had very strong performance at Diablo Canyon.

We recently had a refueling this year. And we completed that refueling in just under 30 days which was the shortest for that particular unit. And is a very good outage,it's very safe.

We have a number of parameters that we use to measure how safe we do things at the plant such as our unit performance monitors, safety monitors in terms of whether it's planned events. And this was the safest outage in all those areas that Diablo has ever had.

Talking about the online performance for a minute. We have about an 18 month cycle in terms of the period of time that the units are online.

In the last two outages, the Unit 2

outage in '06 and the Unit 1 outage in '07, both units ran over right about 500 days. One was just under. But basically ran the whole 18 months from the time they started up from the previously refueling to the time they shut the unit down. The units were running continuously.

So that adds to the safety and reliability of these units and the low cost. Obviously the longer they're running the more they're running the lower the cost.

So you look at the next slide you'll see trends that we have ongoing at Diablo since the beginning of starting up the plant. And the industry as it has matured is learning how to do shorter outages.

The first graph is the length of the outages. And as you can see we started off with longer outages, the industry did. And we've been shortening those outages accomplishing all of the work we need to accomplish to assure the unit could run safely until the next outage. That's our goal when we shut a unit down and refuel is that we, all the maintenance that we need to do and restore all the equipment to make sure that unit is in safe condition to run for the 18 months.

And you can see we're getting that. And we're shortening the outages on top of that. That overall is bringing the cost of electricity from not only Diablo Canyon but the industry the costs are dropping per kilowatt hour from nuclear plants.

ASSOCIATE MEMBER GEESMAN: Could you explain what the horizontal axis is?

MR. KEENAN: That's the days, that's how long the outage is on the top one.

ASSOCIATE MEMBER GEESMAN: Okay.

MR. KEENAN: So we started up over a 100 days with the first outages and now we're approaching the 30 day range which is getting to be best in industry, not quite, but we're getting very close to it.

ASSOCIATE MEMBER GEESMAN: I was unclear. That was the vertical axis. What's the other?

MR. KEENAN: Oh, I'm sorry. Oh, that's the refuel outage. That's refuel outage number one, refuel outage number two.

ASSOCIATE MEMBER GEESMAN: Oh, okay.

MR. KEENAN: The first number is the

unit, Unit 1, refuel one, Unit 2, refuel one.

ASSOCIATE MEMBER GEESMAN: Okay.

MR. KEENAN: Sorry I, okay. The second graph is our operating capacity factor. And that's capacity factor for when we start the unit up to when we shut it down.

And you can see at Diablo those numbers have been continuously improving, and in fact, since the third refueling outage we've had an on-site capacity factors above 90 percent. And we're now actually in the 100 percent range because of the continuous operation.

ASSOCIATE MEMBER GEESMAN: You appeared to have had a little blip on cycle number 12 in both graphs.

MR. KEENAN: That's correct.

ASSOCIATE MEMBER GEESMAN: When would that have been?

MR. KEENAN: That would have been about four to five years ago because they're 18 month cycles.

ASSOCIATE MEMBER GEESMAN: Okay, thanks.

MR. KEENAN: Okay. Okay so looking again at the economics overall our projection for this year was about 3.8 cents. And that's what we used when we looked at how we're going to operate Diablo Canyon and how we will, would impact our customers. And that includes all costs of fuel, operations and maintenance and capital and depreciation costs.

And certainly that's less than our in our market price reference of eight cents. We actually believe that as we're going through this year and having a very good year we'll come in around three and a half cents at Diablo Canyon.

And that actually will make us make Diablo Canyon the cheapest generation that we have. Hydro on a good year will be a little bit cheaper than nuclear. This year is not a good year for hydro so it will be more expensive than nuclear.

We continue to invest in our nuclear plant. As you can see a number of investments there with the turbine rotor replacements which are done, the dry-cask storage, steam generators coming up and reactor head coming up. And those are fairly expensive modes that we're either doing or going to be doing in the future.

But overall we make sure that Diablo Canyon has the proper maintenance and equipment in place to be a safe and reliable plant.

One of the things that the nuclear industry is benefitting from is the improvement in materials that have happened over the last 30 or 40 years since these plants were built. We have much better materials now.

The steam generators, for example, are not like replacements. They have better materials in them. They'll last much longer. They'll be easier to take of. Reactor heads that they're making today are one-piece reactor heads. There's no, there will be no weld segments and our reactor head will be one-piece forging. Again, much better material and will perform very well for us.

So material improvements have made a big difference. And it really has generated a lot of the modifications that we do at nuclear plants is because we can put in material that will be less maintenance and it'll last longer.

We, on the average, have been spending up to now which is going to be increased about $70 million a year at Diablo Canyon to improve the conditions of the plant and make sure that we maintain the equipment safe.

Even with the amount of future

improvements you see here we expect that our overall costs per kilowatt hour to generate electricity will not be much over four cents. It'll probably just creep up over four cents.

So from the 3.5 to 3.8 we're going to be this year somewhere in between there. Future years after 2010 after these things we expect we'll be 4.1, 4.15 something in that range.

And you can see obviously we provide significant economic benefit to the local area. It's what you see on the study here which was done in 2004. I'm sure that has increased.

Taking a look overall in the US and the world perspective, in the US nuclear is 20 percent of the energy right now. We've been running about 20 percent for quite some time.

And that's without really adding any more nuclear power plants. And the reason we'll be able to maintain the 20 percent number as the usage in the United States has gone up is that the performance of the nuclear power plants has improved such that we're generating more safe, reliable energy. So we're maintaining that 20 percent.

Right now in the US utilities have

announce actually over 30 new reactors that they plan to build. And a number of those utilities are working on applications to the NRC for licenses to construct and operate nuclear power plants.

The International Atomic Energy Agency is anticipating about 60 new plants in other countries over the next 15 years.

So nuclear power is certainly still going to be active and going to be relied upon for energy throughout the world.

I think the main reasons for that is the fact that the many countries are looking for energy independence and diversity in fuel. Obviously oil and natural gas have had limitations and place considerable price fluctuations. And, of course, global greenhouse gases have significantly placed a big part in the world in the last certainly five to ten years and seems to be growing every day.

Recent studies including the Keystone Center Report which I believe you're familiar with indicate that nuclear power needs to be kept as an option and available for us in the future to solve our energy needs.

And I've just put some data down here on reliance on nuclear power from some other countries that you can see.

So in closing I want to make a few facts. And that's that we work very, very hard to ensure the safe, reliable, cost-efficient, baseload generation at Diablo Canyon for our customers of California.

We believe that without nuclear we would have a significant, difficult time maintaining lower costs to our customers. And we would significantly increase in our global gases that we would generate.

We also believe it's an important option certainly for California to maintain, certainly want to maintain the generation that we have in California and an important option in the future.

We need to look at how we're going to meet California's energy needs and the global greenhouse gas goals that California has set for it. And we believe that nuclear power has to be considered as part of that.

We do recognize as you've heard today that the 104 reactors that operate in the United States from time to time there are some performance issues. At Diablo Canyon we are on guard for those performance issues.

In my 37 years mostly in nuclear I've been through some of those and seen some of those. I spent two years on loan to the Institute of Nuclear Power Operation doing evaluations of other plants.

And I have a good understanding of what can cause performance issues at nuclear power plants. I can assure you that we are on guard to make sure that doesn't happen at Diablo Canyon. And we will not let that happen.

I think that brings me to the end of my presentation. Are there any questions?

PRESIDING MEMBER PFANNENSTIEL: Thank you Mr. Keenan. Questions, Commissioner Boyd.

COMMISSIONER BOYD: Yes, thank you for your presentation and Diablo is indeed impressive. In the discussions we've had today of Palo Verde and I want to just bridge over to Diablo Canyon and you are justly proud of your safety record and a good record, what do you do to address the culture and complacency issues that we discussed with regard to Palo Verde and to perhaps avoid falling into that same regime.

MR. KEENAN: That's a great question. First of all I make sure I have people that as well as we might do say this refueling outage which we thought we did very well. We set a number of stretch goals, very stretch goals for safety and a number of other areas.

And, in fact, for personnel safety we had a goal of zero injuries this outage. We didn't achieve those goals. So when we don't achieve our goals we look at why we didn't achieve our goals and what corrective actions we need to put in place to get better than where we are.

So we don't measure ourselves of what we just did. We measure ourselves against stretched goals that are often not able to be achieved. That way there we can fight complacency by always trying to get better regardless of our performance.

So I like to be proud of our performance but not satisfied. So I make sure that the people we have in place have that kind of culture that we have not achieved where we need to go. And I think that's really where INPO in studying other power operations comes into play.

When they evaluate us they evaluate us

to excellence. And, of course, when you're evaluated to perfection you don't always come out so good. And that allows us to be continually to strive to get to the places that are look like excellence and look like the very best in the industry and still then we're not going to be where we want to be.

So it's having that continuous improvement and not being satisfied with our performance that prevents complacency.

COMMISSIONER BOYD: Thank you. Another question, on your spent-fuel facility ISFSI as we affectionately call them. How rapidly do you, if you can talk about this, how rapidly do you think you will get fuel transferred into that facility such that your spent-fuel pool gets closer to the original goal only maintaining the spent-fuel for roughly five years was the figure, I think, that's been standard before DOE was to take it away.

MR. KEENAN: Well, we presently plan to complete this facility next year. And given things that are going on that I don't know exactly how they'll end up in terms of maybe legal issues et cetera, but it would be our plan to when we complete the facility if everything else is in place to start loading the ISFSI next year.

COMMISSIONER BOYD: And you predict how long it would take to evacuate your pool down to a lower level. Do you figure about 75 percent capacity now. Do you have a goal of, and a timetable to get to a lower level in the spent-fuel pool?

MR. KEENAN: We do. I actually can't speak to that now but I can get you that answer. We do have a goal to continue to move the fuel into safe, dry storage and reduce the size of the amount that's in the pool. I do not have those numbers with me but I'm sure we can get those for you.

COMMISSIONER BOYD: Thank you. That's all.

ASSOCIATE MEMBER GEESMAN: Mr. Keenan I want to thank you for being here today and if nobody else in the California regulatory process has done so to welcome you to California.

MR. KEENAN: Thank you very much. I appreciate it. And again I'm glad to be here. And I'm learning a lot.

ASSOCIATE MEMBER GEESMAN: I would also compliment your company. I found that the completeness and candor in written materials that PG&E provided us to be a big improvement from two years ago. And to the extent that you contributed to that at all I certainly want to say that's progress in the right direction.

MR. KEENAN: Great, thank you. I think openness is incredibly important. And we will certainly continue to do that. And if you have questions at any point in time any of us, especially myself, I'd love to discuss them with you.

ASSOCIATE MEMBER GEESMAN: We appreciate that. I wonder if you would expand a bit on your professional experience at INPO and describe to us what INPO's role is and how that may be potentially of relevance to a state regulator.

MR. KEENAN: Well, you know INPO was put together by the utilities, executives of the utilities after Three Mile Island recognizing that industry events have a very negative impact on our industry.

And safety events are something that we do not want to have happen. So we decided that we wanted our own regulator so to speak, an industry regulator. And that we would start after a lot of work trying to figure out what the right thing to do was, our own, quote, regulation. And that's how the Institute of Nuclear Power Operation got started.

And basically there was some key executives that were put there and some industry experts that were put there to form the basis of INPO. But they do bring a lot of people in like myself who have a lot of industry experience.

At the time I went into INPO I had been over 20 years experience, I had been a plant manager for seven years and they really have a set of high standards that we use to go out and evaluate the plants on.

So basically they wrote up some performance standards. And these were written against excellence what you would expect to see. And they continually modified those standards such that as they learn more and see issues as they happen in the industry those standards are lessons learned get fed back into those standards such that they're changing.

And so basically when I got there I was trained to the level of those standards, put with teams and, of course, the first couple of teams I went out with was to be trained and we evaluated plants under training with experienced evaluators.

And when we looked at them we looked at them from those standards of excellence. And so it just made a lot of sense as we evaluated plants that we gave them lots of information on how they could improve.

And the other thing in just, it's not just errors from proven it's also strengths. And so some plants that they saw they were doing things really well they wanted to make sure they documented that strength because one of the main things about INPO is to share the information. Okay, so strengths get shared among other plants. And lessons learned get shared.

So if you're really focussing on what's going on at INPO and utilizing their strengths you can make your plant one of the very best plants. Now part of doing that is having people obviously that are some of the very best people.

But if you implement the strengths from INPO that they've seen out in the 104 different sites that they go to different plants you can get an awful lot out of that at any particular plant.

So we continue to loan people there.

We've got at least one person there right now. We're looking at getting a second person there.

I'm actually, they have people they call a reverse loanee and I've actually asked INPO to have a reverse loanee which means one of the INPO people come and take a job in my plant for a period of time and they help us with what they've learned at INPO. And they become one of the members of my team.

And so we're working with INPO to actually have a reverse loanee. And that person also gets to see actual industry experience in addition to sharing what he's learned at INPO. He's one of the permanent people not one of the loanees now I'm talking about.

So the INPO has come about with really how do we make the industry the top performers, the excellence and I believe has had a lot to do also and with the NRC to really raise the bar and it's the reason you're seeing the industry with much better performance and much less there's very, very few safety related incidents if any in our industry any more. I mean the number of reactor trips and other things that have happened have been greatly reduced.

And I think it has a lot to do with the INPO being and also being backed by the NRC.

ASSOCIATE MEMBER GEESMAN: How frequent is the plant review cycle?

MR. KEENAN: Basically if you're a strong performing plant a one or a two typically it's every two years, every two years. And I believe some of the lower-rated plants I think it's 18 months. They come out more often.

ASSOCIATE MEMBER GEESMAN: And INPO then establishes an index?

MR. KEENAN: There is an INPO index. That's correct. And that is based on goals that they want to achieve, the industry to achieve further away. Like right now in 2005 they put out the 2010 goals and that has goals in terms of safety system performance, has goals for safety, personal safety, has goals for radiation exposure. There's about 10 fuel performance, those types of things. There's about 10 significant issues.

And if you can meet their goal you can get enough points to get to 100. That is the maximum you can get. If you meet all of these goals for 2010 you get 100 points. Diablo presently is 96, I think, point something.

ASSOCIATE MEMBER GEESMAN: Ninety-six point nineteen according to the written material you've provided.

MR. KEENAN: Thank you.

ASSOCIATE MEMBER GEESMAN: Now the written information suggests that that's up from 82.5 in 2002. How long have these ratings been given by INPO?

MR. KEENAN: That index, I can't tell you exactly but I guess was started probably in around I'm guessing around the 90s the early 90s. They didn't always have that. That was something new they came up with. So they didn't have it originally.

ASSOCIATE MEMBER GEESMAN: So do you know if from PG&E's standpoint it's been a steady drive up since the early 90s or have there been some dips along the way?

MR. KEENAN: It was actually a very good increase through the 90s. Diablo as you see has been a good operating plant. There were some small dips which I can get you. There were some dips maybe back into the upper 80s in the 2000 to the 2002 time frame.

ASSOCIATE MEMBER GEESMAN: What

information is public and what's private in terms of the INPO process.

MR. KEENAN: Well the INPO evaluations are private. The INPO index we don't publish it. But it seems to be more widely known. But the evaluations and the ratings are considered private. But I believe we're working to share those with you based on our relationship with INPO. So we can get agreement on how we can share them and make sure they're protected if we share them.

ASSOCIATE MEMBER GEESMAN: Thank you very much.

COMMISSIONER BOYD: Thank you Mr. Keenan. I also share with my fellow Commissioners, it's very much appreciated that you're here today.

MR. KEENAN: Thank you.

COMMISSIONER BOYD: That you would take the time to be here. I'm curious with regard to the dry-cask storage that you're doing at Diablo Canyon regardless of what and when the DOE takes fuel are you able to provide on-site storage for 40 or 60 years?

MR. KEENAN: The present design would

get Diablo Canyon through the end of its licensed, present license time frame and be able to load all fuel in the ISFSI.

COMMISSIONER BOYD: As I recall I think you're also taking fuel from Humboldt. Is that correct?

MR. KEENAN: No we're not bringing the fuel from Humboldt down to Diablo Canyon. We're building a separate ISFSI at Humboldt. In fact it started just last month or two to store the fuel in the ISFSI at Humboldt.

COMMISSIONER BOYD: Okay. Maybe that's what I'm confusing is that they're both being done, they're both being held at the same time.

MR. KEENAN: That's correct.

COMMISSIONER BOYD: Given the low cost and excellent operating history of these units am I correct to assume that PG&E will likely apply for a license renewal application?

MR. KEENAN: Well, as you know that's what the feasibility study is all about. It's certainly, if the feasibility study goes well we certainly would think that would be a potential outcome is that we could extend the life of those so that we could serve our customers at low cost.

And without no greenhouse gases. But the study will really tell us whether that makes sense.

You know the economics need to obviously work out too. But right now they look pretty good.

COMMISSIONER BOYD: Okay. When will that study be done?

MR. KEENAN: I believe that study is done in '09.

COMMISSIONER BOYD: Okay.

MR. KEENAN: We're just going to get ready to start it.

COMMISSIONER BOYD: Again, thank you.

MR. KEENAN: Okay, thank you.

PRESIDING MEMBER PFANNENSTIEL: Mr. Keenan I don't have any specific questions. I do want to thank PG&E for having you as a Senior Nuclear Officer come here. As I said before it's real important for us to take a look at nuclear power and its importance to California.

It always has been and I think now in the post AB 32 world it's even more so. So we appreciate your taking your time to come and help us struggle through this. Thank you very much.

MR. KEENAN: Anything I can do I

appreciate it.

PRESIDING MEMBER PFANNENSTIEL: You'll hear from us I'm sure.

MR. KEENAN: Okay, thank you.

PRESIDING MEMBER PFANNENSTIEL: Steve.

MR. McCLARY: We now turn to Southern California Edison and the San Onofre plant. Representing Southern California Edison today is Mr. Gary Schoonyan who probably needs no introduction to the Committee.

Mr. Schoonyan is the Director of Regulatory Affairs for Southern California Edison and represents the company to this Commission.

MR. SCHOONYAN: Thank you, thank you Commissioners. If we could move to the second slide please.

I will be -- I'm Gary Schoonyan. I'm from the Southern California Edison Company. I will primarily be talking about SONGS 2 and 3. I believe between Bill Jones and Steve Olea pretty much the Palo Verde discussion has taken place today.

However I would say as a minority owner in those three facilities we're definitely concerned with regards to Palo Verde. And at least particularly with the ratings that they're presently at particularly Unit 3.

But at least the indications that we have seen that they're starting to take the necessary steps to try and return performance to a higher level and hopefully get back to a one sort of a level. And we're going to do all we can to make sure that such occurs.

If we could turn to the next slide.

COMMISSIONER BOYD: Could I rudely interrupt with a question on that point Gary before you move on. You raised a question in my mind about being a minority owner what role do you have in the operation of Palo Verde and in addressing the questions that you indicate you're concerned about there.

MR. SCHOONYAN: Well as far as the physical operation of the facility we basically provide guidance and insight. We're not the operating agent.

But as an owner we have a distinct influence over the things that do occur with regards to budgets and the way things are performed.

Furthermore we have as I'll get into a

little later a very good record at San Onofre 2 and 3 with regards to operations. And I think there's a number of things that we have done and will, as best we can, share with the operators at Palo Verde to try and instill a safety culture that appears to be one of the key fundamental areas that of concern with the NRC.

COMMISSIONER BOYD: I will presume that's not been the practice in the past.

MR. SCHOONYAN: It has been the practice per se however to the degree of that, I mean, as has been mentioned the facility at Palo Verde has been operating as one of the higher ranking facilities in the nation for some time.

How it got complacency or wherever the case may be to the situation where it's at now that is something that needs to be debated and reviewed. Because there will be lessons learned from that in and of itself.

But it's not that we have tried to basically involve ourselves in trying to do the necessary things to keep it at the higher level.

COMMISSIONER BOYD: Thank you.

ASSOCIATE MEMBER GEESMAN: If we can stay on Palo Verde for a minute. And again from the perspective of a minority owner what weight to you attach to the INPO rating? How good an indicator is that as to problems at the plant?

MR. SCHOONYAN: From our perspective it's a fairly good indicator. I mean, it's, they're frequently reviewed. I mean taken in the context with what the NRC does it's basically NRC as was explained primarily focusses on safety, environmental and those sorts of issues which are paramount to a nuclear power plant.

The INPO reporting at least as I understand it and what I've seen, it's involved also into other areas, efficiency and other things. And so it does provide some additional information that typically the NRC reporting does not.

ASSOCIATE MEMBER GEESMAN: How much of an advanced warning did it provide that Palo Verde was headed off track?

MR. SCHOONYAN: I do not have an answer for that. I will get that.

ASSOCIATE MEMBER GEESMAN: Do you know what the current INPO rating for the plant is?

MR. SCHOONYAN: I do not.

ASSOCIATE MEMBER GEESMAN: If you could

get that and some historical perspective from INPO's standpoint on Palo Verde. I think what's difficult for us to determine is the extent to which it's purely a rear view mirror view or perhaps more of a coal miner's canary that can actually provide some usefulness to a state regulator. And I certainly appreciate any information you can share with us.

MR. SCHOONYAN: Okay. If we could turn to the next slide or are we there, pardon me.

SONGS 2 and 3 are baseload resources and have been operating safely. I mentioned before that as far as the NRC goes, and as Bill Jones had indicated, there are three key performance areas and 19 different cornerstones.

We basically have registered green which is the highest rating in all 19 of those areas at San Onofre and are currently in the column one position with regards to that facility.

There was some mention today of the instrument air malfunction that occurred last Thursday. And as a result of that as Bill Jones indicated as there are a couple of inspectors out there reviewing the facilities right now.

At least from my understanding this

inspection was triggered or is triggered whenever an outage occurs that affects multiple safety systems. And this particular air malfunction does have an impact on safety systems. As was indicated all of those systems reacted and performed as expected and everything was fine. However that's what triggered the inspection.

And here again, although you do not things of this nature to occur there's always lessons to be learned. And to the extent with those lessons you can incorporate and do an ever improving job going forward.

With regards to reliability the facility has been very reliable over the years. There was a comment made on Monday, something about the 2006 being lower than normal. That was predominately scheduled outages. That we had 176 unit days of scheduled outages on both of the units combined, Units 2 and 3.

That right alone encompasses about the equivalent of a 24 percent capacity factor. On top of that there was Unit 2 was delayed in returning to service. We had a forced outage on Unit 3 to basically result in the 72 percent capacity factor that was reported in 2006.

However as I mentioned the vast majority of that was scheduled outages and I might add one of the scheduled outages for Unit 3 we actually took some extra time. We brought the unit down prior to the summer. It was when the normal cycle of refuelings occur. We're on roughly a two year cycle at SONGS. And it would have occurred in the summer. So we did some things early to make sure that the unit was brought back in the summer, it was. And then it went down a little bit later in the year.

Cost effectively, the unit is operated very cost effectively. Our costs are under four cents a kilowatt hour, loaded, fully. Every year as PG&E had indicated will increase with the steam generator replacement and the costs as those get rolled in. But even with those we're looking at operating costs substantially below alternative costs.

And as was mentioned there's no directly emitted greenhouse gases. Obviously on a lifecycle basis there are some. There are various estimates with regards to what these are. But I think in all instances they're quite low compared to other generating technologies.

And I think as the report, the draft report points out is when you do talk about these lifecycle comparisons what's really important is that the comparisons compare apples to apples. Like I said there's a wide range of numbers. But usually that's a result of the assumptions that went into the assessment.

And in closing on this particular slide that we look at continued value of these units to the extent that license renewal is pursued. I will get into that a little bit later.

However there is a high likelihood that we'll be requesting funding to study that similar to what PG&E did as part of this upcoming GRC. We'll be filing the NOI and that I think in a month or so.

Turn to the next slide. On steam generator replacement, and I do want to indicate that there's an error on this. It's up in the title. It's really to be completed in 2010 and 2011. And I will give the office an updated slide so your files are correct on that.

PRESIDING MEMBER PFANNENSTIEL: Thank you.

MR. SCHOONYAN: All the other literature

we had and responses indicate that 2010, 2011. I'm not going to spend a lot of time on this particular slide other than the fact that everything is progressing satisfactorily at this point in time.

We're replacing the steam generators which were made of the inconel 600 metallurgy with the inconel 690 which should last an extremely long time once replaced. And that replacement is completed in 2010, 2011.

I might also add that we're similar to what PG&E is doing going to be replacing the reactor vessel heads. That will occur at the conclusion of these steam generator replacement outages probably the year following is what we're currently planning on schedule. So we're looking like at 2012 to basically to commence that particular effort.

With regards to that we did make some repairs already to the reactor vessel head, I believe, on Unit 3 in 2004. Turn to the next slide.

Regarding spent fuel storage, from our perspective there's adequate facilities available for the safe storage on for existing facilities as well as new plants to the extent that they come into play elsewhere.

However this does not mean that we shouldn't proceed sooner rather than later with a permanent geologic depository. Even if you go with the reprocessing route you still need the permanent geologic repository.

It was brought up last year that we were one of the originators or original participants in that private fuel storage. We still have a very small interest in that. We ceased providing additional in 2001 primarily because of the decommissioning of SONGS 2 and the dry-cask storage. We decided to go with that approach on as far an interim as concerned.

We presently have 31 canisters of dry storage on site. Twenty-five are loaded. The site is capable of, well will be capable of handling 93 which will carry us through at least the operating licenses that exist now, which is 2022.

The canisters that we've designed are dual storage and transport canisters. And in fact from our perspective they could be used for directly storing the fuel in a permanent storage.

However it's our understanding that the DOA (sic) is yet to finalize their design nor has the NRC approved the final design of what that storage is. But at least the canisters that we have are capable of not only storing the fuel on-site for an extended period but be used to transport to the permanent facility.

One added thing on there. We are in the process of developing additional pad expansion at the site to basically accommodate the full 93 total canisters that will be required.

Turn to the next slide. As far as the benefits of SONGS and license renewal because I know that that's seem to weigh heavy on the minds of this Commission as well as others is what's going to happen. Basically the existing regulatory processes provide the oversight from our perspective for the continued operation and protection of the public.

The CPUC will obviously consider the role of SONGS 2 and 3 in meeting Californians' needs in the future. As far as the license, any sort of a license renewal process have to go before them. The Energy Commission, obviously as you're doing now, will conduct assessments via its

IEPR processes and what have you.

PG&E has indicated they've already started the process as a result of the Commission decision and have to address various issues of cost effectiveness, the address aging as well as other sorts of things.

We're most likely, high likelihood of requesting funding to do similar and planned based upon satisfactory completion of that to basically proceed with a study and an assessment based upon any positive results of that received with the license renewal of SONGS 2 and 3.

I'd like to also on this slide although I didn't provide one, just a little bit of discussion in regards to once-through cooling. That's obviously an issue.

At San Onofre and working with the Coastal Commission Edison has done a number of things from our perspective that mitigate any adverse impacts associated with entrainment, impingement or even thermal impacts with regards to the once-through cooling.

Not only did our original design have features including mid-water intake equipped with velocity caps, angled screens, fish returns associated with it. We've also began the restoring of a 150 acres of wetlands in the San Diego area to be completed next year.

Basically the Coastal Commission has indicated this fully compensates for organisms entrained in the plant.

In addition to that we're helping to fund a white sea bass hatchery in the San Diego area. And we're completing the design and hopefully start construction March of next year for a 150 acre of coastal, reef habitat to basically mitigate a lot of the discharge concerns. So from our perspective we've fully mitigated all of the issues associated with the once-through cooling.

However there are continued studies. I know even this Commission has had correspondence with the State Lands Commission with regards to the use of dry cooling or wet cooling. I think as this Commission indicated that dry cooling is does not appear feasible. And even with cooling towers it would be very expensive and represents very significant engineering challenges.

The challenges even go beyond that from our perspective. I mean in essence at San Onofre there really isn't any real estate to, for lack of better words, to house cooling towers. And there really isn't any water. We would need about 50 million gallons of water a day needed. So you'd have to go to seawater and there's all sorts of environmental concerns with the saltwater plumes and everything else.

So even if you got through the engineering difficulties associated with putting up cooling towers and the financial commitments necessary to do that it would be from our perspective extremely difficult to even license the thing due to the environmental impacts associated to the area.

With regards to decommissioning Two while I'm still on this slide. We're pretty well funded with regards to decommissioning with anticipation of continued funding that we're getting. We presently have about $2 billion in our decommissioning fund for SONGS 2 and 3. And over 700 million for Palo Verde. And there's a little bit left for San Onofre 1.

Turn to the next slide. And I think this is the final one. And this gets to more of a planning perspective both from a renewal license,

license renewal perspective but also the future.

And one of the concerns we have is it appears there's some discussion with regards of removing nuclear as an option going forward with regards to serving the state's needs. And as a state we should not be limiting our options. This isn't to say we should sacrifice anything or be it sound or reasonable oversight or anything along that line.

But the wedge that we discussed last Monday, it's going to take a lot more than just any one or two options to do that. It's going to take a full portfolio of options. I doubt that even a group of options would be sufficient to do what's required by if you hoped to get to a point of 2050 with regards to that.

So the state from our perspective needs to start at least considering opening the door a crack to considering as a potential option down the road. Not only to the extent that license renewal makes sense with regards to the existing facilities but there may be situations down the road where you would want to start developing options. If nothing more than potentially consider maybe an early site permit with the NRC which is a very extended process in and of itself to get a site certified that it might be worthwhile to consider doing something along those lines to have a site in place st such point in time if the designs, this kind of standard designs comes to fruition and other things that make it sensible to move forward. We can move forward a little quicker. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thanks Gary. Questions?

COMMISSIONER BOYD: It's not so much a question perhaps just a comment. Thank you Gary for being here. I appreciate you mentioning the once-through cooling. I appreciate you mentioning lifecycle analysis of not only the greenhouse gas emissions climate change issue but lifecycle costing, lifecycle analysis of environmental footprints those are issues that here in the 21st Century as you know we talk about on a regular basis.

So when it comes to dealing with the attributes of nuclear there's no denying in a nuclear plant operating doesn't put out any greenhouse gas emissions. We are now in the world of in the realm of in the business of looking at cradle to grave and all the consequences thereof.

So that's something this agency has to deal with. And I appreciate you mentioning that.

Other than that I just would like to follow up as you indicated on the Palo Verde issue and probably have some more dialogue with your company about how you see that situation and where we might be going on that mainly just to fulfill my role as State Liaison Officer I have been alerted to all of this. Thank you very much.

MR. SCHOONYAN: And in following up on that, Commissioner Boyd, we'd be more than willing to have our representatives that actually work with the plant to meet with you at your convenience.

PRESIDING MEMBER PFANNENSTIEL: Yes, Commissioner Byron.

COMMISSIONER BYRON: Mr. Schoonyan thank you as well for being here today. On your last slide, you were here as well on Monday correct?

MR. SCHOONYAN: Correct.

COMMISSIONER BYRON: Your last slide indicates California should take appropriate steps to maintain a nuclear option. Do you have any specific recommendations for this Commission?

MR. SCHOONYAN: Well, I mean in essence and I think I got to it a little bit with my discussion on that. There will potentially and fairly likelihood be renewal proposals that come before the state. And they need to be seriously considered. I think they will be.

But it also gets to the fact that it's more from a planning perspective here is that we should not just remove nuclear as an option going forward. Obviously there's legislation, there's statutory requirements that need to be addressed by this Commission and by the state with regards to permanent fuel storage and what have you. But there may be things that could be done to move forward and cut some of the lead times down while these other things are occurring. And I guess the only thing I'm suggesting is that there at least need to be a consideration of that by this Commission.

COMMISSIONER BYRON: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Gary is Edison investing in that? Is Edison investing in future nuclear in California like for example doing some site studies or any potential --

MR. SCHOONYAN: At this point in time,

no. However at our general rate case we did receive some funding for project development work. And as part of that --

PRESIDING MEMBER PFANNENSTIEL: For nuclear, I'm sorry nuclear projects?

MR. SCHOONYAN: No, no, this is just in general. It's some of the funds that we use to basically do this hydrogen project that with the proposals we have at the Utilities Commission right now. As part of that project development there has been some very cursory assessments of this with regards to background, what's the art of the possible, nothing looking at sites per se. It's more trying to get a feel for the lay of the land. Not only in California but elsewhere. But it's minimal amount of work --

PRESIDING MEMBER PFANNENSTIEL: Well your recommendation is the state should do that. I'm wondering shouldn't the utilities make some investments if it looks like something that might be a future prospect for you.

MR. SCHOONYAN: That's where it basically has to originate from however proceeding down these lines is it takes a little bit of money too and in all instances what would happen is most likely there'd be proposals to the Utilities Commission for funding providing the scope of work and what have you to basically pursue this.

Because just getting an early site permit is a substantial effort. It takes a substantial amount of time, effort and money to proceed with something like that.

And obviously the state would be actively involved in that.

PRESIDING MEMBER PFANNENSTIEL: May I ask Mr. Keenan whether PG&E is investing in that way at this point.

MR. KEENAN: At this point basically what we're doing is looking at how we're going to serve our customers out into the future. And typically as you know that's kind of a 10 year window we look at. But as deciding what sources of energy we're going to use we need to look further than 10 years.

So we've recently had a study ongoing that looks out about 25 years and how we're going to serve our customers. And in that study we have included nuclear. The one of the things in building new nuclears is that it would take somewhere in the ballpark of nine to eleven years to actually if we said today I want to have a nuclear plant producing for our customers we believe that it will be nine to eleven years before we'll get our first megawatt from that plant.

That's why we extended our study and tried to look at what resources we need. And obviously we're going to do everything we can with the right, using the right order with demand control and renewables et cetera. But when we look at that it leaves us not fully satisfying the ability to serve our customers.

And some of that is based on trying to project an accurate load growth. And one of the things you're hearing more about today is plug-in vehicles. So the load growth is a little harder to predict because if plug-in vehicles are going to become one of our major sources of reducing greenhouse gases if you do produce that energy with natural gas it does reduce greenhouse gases a certain extent. But if you're able to produce that energy with nuclear you'd have a tremendous improvement in greenhouse gases in California.

So we're trying to make sure we're doing the study in a manner that takes into account our fuel diversity. Again, to get from becoming very, very dependent on natural gas as we move forward. And how we're going to supply our customers at a reasonable cost and greenhouse gases as we move forward.

So nuclear is in that study and we certainly at some point in time and I believe similar comments that you just heard believe that we need to keep that option open to us. One of the concerns that we have is that we don't want to wait too long to maybe start that option in and assess it as we go along.

It may be that getting a permit may take five years. Well three or four years from now you might say there's been technicalogical breakthroughs and renewables are the way to go because we can store energy or the costs are coming down. It's something that has to be constantly looked at. And we are looking at it very hard. And we believe also that the nuclear option should be remain open in California. But if it isn't the other question might be can we import some nuclear option into California.

PRESIDING MEMBER PFANNENSTIEL: And so I just want to make sure that I'm getting the same answers I got from Mr. Schoonyan, you're looking at keeping it open but you haven't invested any money at this point. But you might be willing to do so in the next few years.

MR. KEENAN: I believe --

PRESIDING MEMBER PFANNENSTIEL: Whether it's for a site selection or license or something that's possible. I'm trying to figure out whether you're at that point of putting some shareholder money into this or as Edison I think is saying is you wouldn't put shareholder money into it but you would see if you could get the PUC to approve some ratepayer money.

MR. KEENAN: Well that certainly is, we have not made that decision yet. That's an option as to put shareholder or ratepayer money into it. But we have not made that decision yet in moving forward. But we are studying it very hard. And we have not made a decision on expending funds from either source at this point in time.

PRESIDING MEMBER PFANNENSTIEL: But you might look out of state also you said.

MR. KEENAN: That's correct.

PRESIDING MEMBER PFANNENSTIEL: And Mr. Schoonyan how about Edison. Are you looking out of California for the possibility of additional nuclear that you could import into the state?

MR. SCHOONYAN: Not actively but here again I don't want to foreclose any options.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Other questions? Steve where do we go at this point. Should we bring up the next panelist or do you think we need to break for lunch now?

MR. McCLARY: We have two more panelists.

PRESIDING MEMBER PFANNENSTIEL: For the morning session.

MR. McCLARY: For the morning session, yes. And I'm not sure if they have schedule constraints themselves but I would anticipate if we went ahead we would probably finish 12:15 to 12:30.

PRESIDING MEMBER PFANNENSTIEL: Then let's proceed.

MR. McCLARY: All right. Our next two panelists are more a general overview of nuclear plant operations and considerations. We first have Mr. David Lochbaum who's the Director of the Nuclear Safety Project for the Union of Concerned Scientists.

Mr. Lochbaum has been with UCS since 1996. Prior to that he spent over 17 years in the commercial nuclear industry in a range of operations from start up testing, operations, licensing, training at by my count something like 13 different nuclear plants across the country.

He has a Bachelor of Science in Nuclear Engineering and has been a member of the American Nuclear Society since 1978. Mr. Lochbaum.

MR. LOCHBAUM: Good morning, on behalf of the Union of Concerned Scientists and the 20 percent of our members residing in California I greatly appreciate this opportunity to share our perspectives during this workshop.

UCS has monitored safety levels at US nuclear power plants for more than 35 years. We are as concerned today about the risks and reliability of this energy source as we ever have been.

Nuclear power plants have many risks and I'll outline just four of them today. Like real estate key being location nuclear plant reliability depends on management or lack thereof. Slide three please.

Before I outline our concerns I need to

explain the standard we apply when judging nuclear power plant safety levels. We do not apply an unrealistic standard of absolute safety. Instead we apply a reasonable standard of what's acceptably safe. Slide four please.

If there is ever a nuclear plant disaster the federal government will likely take steps to prevent the next disaster. If that list of steps is long then the federal government has let the American public down by not taking some of those steps to prevent that first disaster.

So what we strive for is a shorter list of things to do should that disaster occur. Then the things that should have been done to prevent it. Slide five please.

The risk of aging at nuclear power plants is defined by what is called the bathtub curve due to its shape. Risk is initially high early in life due to infant mortality or the break-in phase. Risk drops lower during peak middle health period but not to zero. And then risk climbs again as the product enters the wear-out phase. Slide six please.

All of the nuclear power plants operating in the United States today are moving towards, if not already in, the wear-out phase of the bathtub curve. Two among many examples of wear-out failures include the February 2001 electrical breaker failure at San Onofre Unit 3 that caused the unit to be out of service for months. And the March 2002 discovery of a very serious near-miss at the Davis-Besse plant in Ohio caused by leakage through a worn out part. Slide seven please.

It may seem incongruous, incongruous, it may seem odd (laughter) I went to school at the University of Tennessee, I shouldn't use multi-syllable words (laughter). But aging nuclear power plants can and do experience break-in failures. Like tires and batteries in cars parts of nuclear power plants are routinely replaced hopefully before they wear out.

In fall of 2004 all 36 pressurizer heaters at Palo Verde Unit Three Plant in Arizona were replaced. The problem was that the replacements were the wrong size causing 25 percent of them to fail right away and the reactor to be shut down the following summer to replace the replacements.

In May 2005 the cracked and worn out

steam dryer at Quad Cities Unit 2 in Illinois was replaced. Within a year its owner was repairing the replacement because of a manufacturing defect in the replacement steam dryer. Slide eight please.

Many reactors like the sodium-reactor experiment here in California did not get out of the break-in phase without experiencing a meltdown or a serious accident. So far we haven't experienced a meltdown during the wear-out phase.

But there's a long list of things that the Nuclear Regulatory Commission is not doing to prevent such disasters. That long list includes how the NRC protects against wear-out failures.

It's impractical to test and inspect every foot of piping or every inch of cable. So the NRC requires plant owners to examine the most vulnerable parts of the plants on the theory that if the most vulnerable parts are okay then the rest is too. But in practice time and time again we learned that either the most vulnerable parts are not being properly identified and therefore monitored or that the most vulnerable parts are being monitored but inadequately.

If you're looking in the wrong places

with the right monitors or if you're looking in the right places with the wrong monitors the result is the same, inadequate protection against aging. Slide nine please.

A couple of examples, the workers at the Quad Cities Nuclear Plant in Illinois inspected a plant component called the jet pump hold down beams. The beams had broken in the past and the NRC required workers to inspect the beams to guard against future failures. The workers at Quad Cities were looking at what they thought were the most vulnerable spots of the beams instead of the whole beam. But the beams were uncooperative in that they broke somewhere else and the inspections did not find them before they broke.

Today the NRC only redraws the boundaries between what is looked at and what is not when such surprises occur.

The right thing to do would be to periodically examine areas outside of those boundaries to hopefully confirm that you've drawn the boundary lines in the right places or to proactively identify any shortfalls and correct them before they become tomorrow's surprises. Slide ten please.

Another example involves the Summer Nuclear Power Plant in South Carolina where workers inspected the welds connecting the largest cooling pipe to the reactor vessel. They looked at that vulnerable weld on that pipe but their detector was uncooperative it lifted off the surface of the welds as it scooted across different size components and therefore it did not indicate cracks that had been there for a while. The result was the reactor restarted without the cracks being identified and repaired. And the plant experienced a serious leak, another surprise.

Likewise a serious accident at Indian Point Unit 2 Plant in New York in February of 2000 was caused by workers examining the steam generator tubes in 1997 with a technique that failed to identify the cracks that were there at the time.

Workers attempts to use highly reliable inspection methods but misses continue to occur. The best way to limit the frequency of misses is to use more than a single inspection method. When diverse highly reliable methods are used the chances that all of them miss signs of damage is minimized. Slide 11.

Safety culture problems have chronically plagued the nuclear industry, appearing far more often than the cameo appearances by seven-year locusts.

And the safety culture measured at the Nuclear Regulatory Commission which I'll allude to in detail a little bit more later is worse than that measured at Point Beach, Davis-Besse, Millstone or any other nuclear plant in the depths of their despair.

There is good news to report on this front. Last year Southern California Edison provided the NRC with the results of a voluntary, periodic, safety, culture survey at its San Onofre Nuclear Power Plant. The results were very good.

They reported numbers that Point Beach, Salem and the NRC would love to have. But instead of patting themselves on the back for producing such good numbers Southern California Edison rolled up their sleeves and went to work on improving what were already really good numbers.

They essentially demonstrated in practice the short-list approach that we've advocated. Slide 12 please.

Turning to the security risk. Last year the United States Government Accountability Office reported that it appeared the NRC established its post 9/11 protective measures on what plant owners could afford to spend and not on what the terrorist threat level was.

For example, it's been reported that the NRC staff recommended to their Commissioners that plants be protected from attackers using rocket-propelled grenades. The nuclear industry heavily lobbied the Commissioners behind closed doors and the Commissioners refused repeatedly to meet with members of the Republic on this subject.

At the end the Commissioners voted against the recommendations from their own staff in a post 9/11 world and opted instead for the cheap fix. Slide 13 please.

The General Accounting Office also observed a post 9/11 security test run at a US nuclear power plant and reported that the mock attacks value was deflated by the defenders having advance knowledge of where the attackers were going to go.

Cheat and cheap should not main ingredients of a post 9/11 security scheme. Slide

14.

Earlier this year the NRC revised its regulations to require that plant owners defend their facilities from an attack by up to X number of outside persons aided by one insider.

Yet those regulations still allow one insider to escort up to twice that number of people with minimal background checks inside the security fences. And to escort that same number of people right into the control room of a nuclear power plant with minimal background checks. Slide 15.

And those NRC regulations updated after 9/11 provide no limit whatsoever on the total number of visitors with minimal background checks that can enter a nuclear power plant.

Just five workers could escort ten times as many visitors inside a nuclear power plant as the NRC's post 9/11 revised DBT level protects against. This may not be the stupidest regulation in history but it's got to rank among the top five. Slide 16 please.

Exelon operates the largest fleet of nuclear power plants in the United States. Exelon reports spending six to seven percent of its annual nuclear budget on security. Wind turbine, solar panels, biomass furnaces and the like do not need protection against terrorist attack. The absolute cheapest way to protect an energy source from terrorist attack is to construct one that doesn't have a hazard to exploit. Slide 17.

The common denominator for the risk from aging, safety culture and security is the federal regulator. A federal regulator that establishes and enforces adequate safety regulations, who will manage those risks to an acceptable load level.

The NRC is not now, and has never been the kind of regulator the American public deserves and expects.

In November of 1984 the NRC allowed San Onofre Unit 1 to restart with known safety problems via a process that the NRC's own lawyers said was legally indefensible. The Commission did it for purely financial reasons.

Twenty years later the Commission Davis-Besse in Ohio to continue running with known safety problems via a process that violated its own procedures and policies. They did it for purely financial reasons. Slide 18.

In the years 2000 and 2001 the NRC

deliberately pulled its inspectors away from Davis-Besse so that those people could approve power uprates and other business activities of the nuclear industry on time.

With hardly any looking the NRC inspectors found nothing wrong at Davis-Besse and issued that company an all-green report card, found no problems in any area. Slide 19.

In April of 2000 one of the few NRC inspectors to visit Davis-Besse was handed this photo showing damage to the reactor vessel head at Davis-Besse. That inspector merely filed it away. The plant restarted and operated for two more years. Slide 20.

In the fall of 2001 concerns about potential reactor vessel head damage prompted the NRC to consider ordering Davis-Besse to be shut down for a safety inspection. They went as far as to draft and order requiring that to occur.

This the NRC's own slide from that decision making process with my highlights in red. The NRC applied five safety criteria and determined that Davis-Besse did not meet any one of the five criteria. Slide 21.

Apparently zero percent is close enough

for the NRC because they opted not to issue the order requiring a safety inspection and allowed Davis-Besse to continue running. Slide 22.

Returning to the safety culture issue. The NRC's own safety culture is worse than at any nuclear power plant I have ever seen. In a 2002 survey of the NRC staff half of the NRC's worker force feeling not free to raise safety concerns. The regulator's staff doesn't feel safe or feel free to raise safety concerns.

By comparison the NRC forced Point Beach, Salem, Davis-Besse, Millstone and others to fix safety culture problems when surveys showed ten to fifteen percent of the work forces at those sites being unable to raise safety concerns. NRC's numbers are epidemic levels compared to those plants.

Four years later in a 2006 survey, the most recent one that was done, there's very little improvement in the NRC's safety culture. Whether it's a long list or short list the top item on the list has to be fixing the safety culture at the NRC so its workers feel free to voice safety concerns. Slide 23.

Shifting from risk to reliability let's

take a look back at the numbers. Two hundred and fifty-nine nuclear power reactors were ordered or proposed in the United States since day one. One hundred and twenty-seven of those reactors were cancelled at various stages up to 90 plus percent constructed. One hundred and thirty-two reactors were also licensed by the NRC or its predecessor the Atomic Energy Commission, 28 reactors have been permanently shut down leaving 104 reactors currently operating.

Over that time 41 of those reactors have had to remain shut down for a year or longer, 10 of them actually did it twice, for a grand total of 51 such year-plus outages to restore safety margins to minimally acceptable levels before they could resume operation. Slide 24.

What do those numbers mean? History tells us that only half of the nuclear power plants ordered actually go into operation. Billions of dollars were wasted on the other half that didn't generate a single watt of electricity in return.

Of the nuclear power reactors that did operate, less than 70 percent of them have avoided one or more year-plus outages to restore safety margins to minimally acceptable levels. Billions of dollars were wasted during those year-plus outages when not a single watt of electricity was produced in return. Slide 25.

Where did those year-plus outages, reactor safety outages occur? From sea to shining sea. You'll note that Nevada, Idaho, New Mexico, Utah, Montana, Wyoming, Indiana and West Virginia did not have nuclear power plants experiencing year-plus safety outages.

To be fair, they cheated. No nuclear power plants operated in those states. Slide 26.

What was the costs of these year-plus outages? It turns out it was approximately $82 billion give or take a nickel. While the Tennessee Valley Authority's Browns Ferry reactors account for the lion's share of that waste these other outages typically cost in the one to two billion dollar range. Slide 27.

What were the causes of these costly reactor safety outages? Four of the outages were needed to repair damage caused by accidents like the 1966 meltdown at Fermi Unit 1 and the 1975 fires at Browns Ferry. Eleven were caused by the replacement or repairs to single large components like steam generators.

But the lion's share, 70 percent of the year-plus outages were caused by an accumulation of safety problems over time that required an army of workers over a year to undo.

In a bizarre, nuclear, groundhog day this cause recurs again and again and again. Forty-five times since the reactor meltdown at Three Mile Island in 1979 this has occurred.

It's wrong for the plant owners to allow so many safety problems to build up. It's equally wrong for the NRC to allow safety margins to drop so low that it takes more than a year and nearly $2 billion to restore. Slide 28.

As I mentioned we apply a short list standard to nuclear safety. There's a very long list of things the NRC needs to do about safety and security.

As a result of not doing these things nuclear power is less safe, less secure and more costly than is necessary simply because the NRC is not doing its job adequately.

We must not wait until American lives are lost in a nuclear disaster before undertaking these reforms. If today's nuclear power plants are to receive extended operating licenses or nuclear power are built, the first step must be the completion of the reforms necessary at the NRC.

That agency needs to become an effective regulator and a reliable guardian of public health and safety. I've mentioned that we apply a short list standard. We also use a short list ourselves for the steps that we need to take in order to get reasonably safe and secure nuclear power.

Our list has one item. Simply reform the NRC. It's such a short list that we don't need to write it down. We can remember even one step. But we do believe we could use some help in accomplishing this one step.

We recognize that the California Energy Commission is not responsible for the NRC and cannot compel the agency to undertake any needed reforms. But we both have access to the United States Congress which does have oversight responsibility for the NRC and can compel the NRC to reform.

We hope the Commission will join UCS in sending clear and repeated messages to the United States Congress that the status quo at the NRC is simply unacceptable if we are to have reasonably safe and secure nuclear power in our futures.

I personally believe the NRC can become a consistently, effective, reliable regulator. Mr. Jones of the NRC outlined the steps the agency is taking to, escalating steps, the agency is taking to improve conditions at Palo Verde.

We've monitored that plant very closely over the last three years and have concluded that NRC Region IV has been doing an excellent job of addressing the declining problem at that site and trying to compel the changes that are needed at that site.

Our goal is to make that kind of performance the rule at the NRC instead of the exception. I appreciate this opportunity to share our perspectives during your process. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you Mr. Lochbaum and we appreciate your coming here and providing that perspective. Are there questions? Thank you.

MR. McCLARY: Next and the final panelist for this morning is Rochelle Becker. Ms. Becker is the Executive Director at the Alliance for Nuclear Responsibility. She's been active on nuclear power safety issues in California for 30 years either in the past with Mothers for Peace or currently with the Alliance and I believe we have another presentation as well. I will turn the podium over to Ms. Becker.

MS. BECKER: First, I've never done PowerPoint before so I hope you all bear with me. I would first very much like to thank the Commission for inviting us to attend today and to talk about our concerns about the costs, benefits and risks of continuing to rely on aging nuclear power plants on a seismically active coast in our state.

I'm also looking forward to the analysis that will be done by the California Energy Commission as mandated by 1632 whose author is my Assemblyman, Mr. Blakeslee, Assemblyman Sam Blakeslee.

I'm really going to try to do this right without doing too much damage to all this equipment. The Alliance for Nuclear Responsibility's purpose here today is to highlight the public's concern regarding the continued operation at aging nuclear reactors.

We are delighted to be included with

renowned experts and stakeholders. The resolution of these concerns impacts 38 million Californians who may also be wondering who will be in charge and who will be charged for the economic impacts should our state allow highly-radioactive wastes to be produced on our seismically-active coast for an additional 20 years.

To date the Nuclear Regulatory Commission has blessed the license renewal for 27 nuclear sites with one or more reactor at each site and has eight more applications on file awaiting approval and 24 more nuclear utilities in queue.

Will the NRC have the human resources or the political will to safely monitor these old reactors while cheerleading for the so-called renaissance of the nuclear industry.

Will the Department of Energy find a solution for the storage of highly-radioactive wastes and if so what will it cost?

Our state has been waiting over 30 years for a solution to the storage of radioactive wastes. We are still waiting. And assuming Yucca ever opens will it be able to handle a high-level radioactive waste that will be produced during the additional 20 years of operation if license renewal applications are filed.

As there is virtually no doubt that the Nuclear Regulatory Commission would approve the applications.

And if those two agencies fail and leave our state faced with a catastrophic radioactive release will FEMA be able to ensure successful emergency actions?

A transparent process with state and public input is absolutely mandatory to resolve these questions.

Since the last Energy Commission workshop in 2005 the Public Utilities Commission or the public has seen a plethora of headlines relating to California's nuclear energy suppliers and their problems. These problems occur even when even though California has some of the most active watchdog organizations in the country.

These are some of the problems at San Onofre, Palo Verde and Diablo Canyon. But I have to admit that we do have the pretties nuclear power plant in the nation (laughter).

The media appears to be most comfortable quoting the assertions of the nuclear industry that new nuclear plants are quote, unquote needed to solve our energy needs and to quote, unquote address climate change.

To say nuclear power is the answer to global warming rings of a secretive, Cheney energy policy versus a responsible, forward-looking energy plan.

The familiar refrain of no new nuclear power plants until the issues of permanent and safe waste storage are in place, economics are market driven and proliferation is addressed has morphed into we should consider nuclear power but remain concerned about waste, economics and proliferation. And that is a very big but.

Media coverage rarely considers the downside, the financial burden continuing to operate reactors designed over 50 years ago.

Yes, Professor Peterson told you I'd be talking about him just a bit and this is his quote. However what he stated was that these old nukes do have seatbelts and shoulder harnesses and safer than motorcycles. Yet if we are to look forward shouldn't we be striving for clean, efficient and cost-effective mass transit versus continuing to drive our seat-belted and radioactive waste-producing Edsels?

Since the beginning of this century the California Public Utilities Commission has approved billions of ratepayer dollars to bail out nuclear utilities and to operate and maintain, replace aging components, increase security and construct on-site storage for high-level radioactive waste.

We don't use the word ISFSI. It is high-level radioactive waste storage and that is what we should call it.

A few years ago the Public Utilities Commission approved the replacement of steam generators at a cost of $700-plus million per nuclear facility. The steam generators like other large and costly components including turbine rotors and reactor vessel heads were designed to last the full 40 year life of the reactors yet failed within 20 years.

Replacements today are no assurance that the new components will last if California's nuclear power plants are allowed to operate beyond current license terms. These replacements and the Nuclear Regulatory Commission's statement that it intends to grant license renewals to all nuclear power plants were the spark that created the Alliance for Nuclear Responsibility.

The Alliance believes our state has a responsibility to ensure future generations as economic, safe and reliable.

We wanted to play PG&E's ad but I don't know if we can do that. Just giving PG&E a little plug here, maybe. It's not going to work, never mind.

Our goal is to encourage 4,000 megawatts of electricity that will not produce high-level radioactive wastes for future generations thereby supporting PG&E's message of wind, sun, water and renewable energy as the wave of the future.

I watched this commercial over and over and over again with this little guy in his red jacket running around in circles. And never once does he say to his classroom, and we need nuclear power too.

Our state cannot afford to get it wrong again. With the advent of SB 1 and AB 32 our state's commitment to clean power supplies is a beacon of light to the world. Yet California is in a three-way tie for first in energy efficiency.

A 2006 study funded by a grant from the

US EPA stated, quote, more and more states are turning to energy efficiency outpacing the federal government by a widening margin and leading the way on appliance standards, building codes, energy efficiency, resource standards and other key policies that drive energy efficiency investment.

The connections that can be gleaned from this data are relevant to the matters before the Energy Commission and the issue of continued reliance on nuclear power.

The top ten states in efficiency represent a wide diversity of democratic data. They are not clustered in one region but represent diversity in climate, size, population and regional distribution.

The top ten leading states have had very active interventions including oversight and/or legal actions by community groups, attorneys general, local and state agencies and state legislators to invoke and enforce state's rights in issues not preempted by the Nuclear Regulatory Commission or in direct challenge to such preemption.

These states have experience both economic and both the economic and reliability vagaries of nuclear power and have compensated for the loss of that power which may be a direct link to their strong showing in implementing energy efficiency. Only four of California's aging reactors remain in operation today.

By comparison the trailing states of Georgia, Virginia and particularly Alabama and Mississippi are states in which the energy utilities have expressed the most interest in building the first nuclear utilities.

Perhaps the states that have sought to un-encumber themselves from the shackles of the older technology will be poised to move ahead with the next generation of truly renewable and green energy. And those that remain mired and dependent on the past will lose that opportunity.

California's willingness to legislate energy policies that balance generation with conservation, reliability, economics and the environment should make all proud.

However nuclear cannot be defined as the green energy. And we need not make a selfish choice for generation. California should not ask state residents to make that choice unless absolutely no other option exists.

In that context the Alliance for Nuclear Responsibility and Sierra Club fail to understand why the California Energy Commission's sister agency the California Public Utilities Commission refused to withhold ratepayer funding until the completion of the Energy Commission's analysis as mandated by 1632.

We were joined by the PUC's Division of Ratepayers Advocates and TURN as well as legislative leaders in requesting that ratepayer funds be delayed until the fruition of the CEC's analysis. However rather than listen to consumer, environmental and elected representatives the PUC added a few qualifiers to the timing of ratepayer compensation and gave PG&E what it requested. This is an historical pattern that has not served California ratepayers well.

Costs are difficult to gauge 15 to 18 years in advance of current license expirations. And the history of cost overruns in the nuclear industry is infamous. Fifteen years ago no one knew that components designed to last the life of the reactors would fail and need expensive replacements. Now ratepayers are being held responsible for $16.8 million for PG&E's third feasibility study of license renewal.

It is important to note that the Nuclear Regulatory Commission does not require the scope of a license, renewal application to include the costs of increasing stockpiles of high-level radioactive wastes, increasing security requirements nor enhanced emergency planning.

The Alliance is grateful to live in a state willing to analyze these important economic impacts.

The resolution of controversial issues of once-through cooling and seismic impacts is very important to this analysis. This information will be extremely valuable in making the analysis meaningful.

A seismically-active coast is not a safe place to store wastes. And even the NRC says west of the Rocky Mountain sites that lie within a range of strong near-field, ground motion from historical earthquakes on large capable faults should be avoided. Yet they are not being avoided, they are being halted temporary.

California seismic history, of the 39 worldwide earthquakes listed on the USGS survey site, 21 of them occurred in California. Since

1900 almost 90 damaging earthquakes with a magnitude of over 6.0 have occurred within the state resulting in billions of dollars of property damage and thousands of deaths and injuries.

Where is radioactive waste stored today? Here's a slide. Here's a seismic map. Where will it be stored tomorrow?

The cost of license renewals to California ratepayers could be considerable yet virtually all these costs remain unknown. For example, the final cost of a permanent storage site for high-level radioactive wastes now being stored under a temporary license on our seismically-active coast without a definition for temporary has been granted.

A permanent solution promised for several decades remains mired in controversy and perhaps the Department of Energy's solution is to change its PR campaign at taxpayers' cost. The, quote, division in charge of disposal and storage of spent nuclear fuel, still radioactive, and radioactive wastes, notably the controversial Yucca Mountain Project is on the hunt for a PR firm to develop its communications and public outreach.

According to Mr. Loux and Ms. Macfarlane the DOE might better use our taxpayer dollars for a deep, geologic site that will protect the public.

Over 2,100 spent-fuel assemblies are now packed tightly together in pools at Diablo Canyon designed for 540 assemblies. Yet PG&E plans to move only enough old radioactive fuel assemblies to replace them with new hotter assemblies. This is their statement before the California Public Utilities Commission, not this, but that was their statement before the California Public Utilities Commission. I don't know where I am on the slides.

Further cost information is needed to determine full economic impacts of aging nuclear reactors, for example, the lack of homeowner or business owner ability to attain private insurance no matter what they are willing to pay could be an incredible economic disaster that's magnitude is greater than either Chernobyl or Katrina.

While the loss of housing and the ability to export all agriculture and dairy from Ukraine was in the billions it pales in comparison to California's agriculture industry which exports over $9 billion annually, a tourism industry which creates $88 billion per year and 900,000 jobs.

A radioactive release, no matter how small, could severely damage these industries and the federal insurance program set up to address these losses is woefully inadequate.

Federally funded nuclear and other energy research from the mid 1950s until 1996 at the site of at least nine nuclear accidents in California including a partial meltdown in 1959 is telling. This meltdown and these accidents have depressed property values and remain the likely cause of significant cancers in the area.

The long-awaited clean up costs for this site was the subject of a bill sponsored by Senator Kuehl which successfully passed out of Assembly Toxics Committee this week.

An example of how this affects a California homeowner whose home represents his largest investment was a subject of a recent LA news article, quote, Scott Ewing was set to open escrow on his $1.7 million home when buyers learned that research had detected higher cancer rates among people living near within two miles of the Santa Susanna Field Lab. Quote, we're bummed, said Ewing who recently bought a home in Simi Valley. Now we have to prove or disprove what's in that study. And the pool of people willing to buy in this area has diminished. And we have to disclose the study to the buyers.

In the last few years strontium and tritium leaks have been discovered off-site at at least seven of our nation's nuclear plants, including San Onofre.

Any incident or even innuendo created by tritium leaks or the stigma of a radioactive release threatens to destabilize home and real estate values, particularly in California's coastal zone which are some of the most highly appraised parcels in the entire nation.

The cost of providing security, infrastructure improvements along our state's rails and roads over which radioactive wastes may some day be shipped to somewhere else must be included in this analysis. Training and providing equipment for the state's first responders will be a continual and costly challenge that will be required as long as waste is produced and temporarily stored on-site.

This is a truck hauling 6,000 pounds of

uranium overturns on I-5 was one of the headlines, Plutonium transit uproar, crash of truck with radioactive wastes released the desert stirs concerns. I know they keep talking about all these shipments that are happening without incidents but somehow the press picks up something that's happened somewhere.

This is a derailment of a train. If a permanent waste site opens how will the waste get there? There's 77,000 tons that need to be transported on our roads and our rails.

The cost of providing security infrastructure improvements along our state's rails and roads I already read that.

The skyrocketing costs of uranium appears to have investors drooling yet this astronomical cost will again impact ratepayers funding for old and obviously deteriorating technology.

Finally on a not all-inclusive list is the economic impacts of California's vital marine works and resources from the use of billions of gallons of once-through cooling and the effects of thermal discharge on its fishing, recreation and coastal communities.

California's reactor communities have additional costs, benefits and risks. Cost, emergency planning. Recently this County of San Luis Obispo's grand jury stated that citing a lack of money and personnel San Luis Obispo County will not carry out the majority of recommendations recently made by the Civil Grand Jury to improve public safety in the event of a radiation release at the Diablo Canyon Nuclear Power Plant.

Also another cost is bringing San Onofre and Diablo Canyon into compliance with recent federal court decisions on water and security.

I had a list of benefits but Mr. Keenan gave them to you and I don't think he needs two bites of the apple. The economic benefits are likely similar in the area surrounding San Onofre, San Clemente and Oceanside.

But San Onofre and Oceanside are not company towns and therefore they're not as dependant as San Luis Obispo on Diablo Canyon's generosity and taxes.

Risks, a radioactive release from Diablo Canyon would place the $1 billion tourist industry in San Luis Obispo at risk. The cost would likely be much higher if there was a radioactive release at San Onofre as Disneyland, Legoland, Sea World, the San Diego Zoo, the Wild Animal Park and the LA Dodgers Stadium or Orange County or whatever they name it now are all within 50 miles of the San Onofre Nuclear Plant.

A radioactive release from Diablo Canyon would place San Luis Obispo's $59 million agricultural industry at risk, likely a bit less for San Onofre.

As more visionary communities step away from PG&E and SCE generation and move towards community choice, munis and off-grid clean and efficient technologies fewer and fewer ratepayers will be left to pay the increasing costs of California's aging nuclear plants.

The California Energy Commission's analysis of costly externalities that are part of a nuclear power plant generation won't finally give our state a true bottom line of what nuclear power costs.

The Nuclear Regulatory Commission considers none of this in their license renewal process but they are costs every California ratepayer deserves to know and which our state government has a right to ascertain and act upon.

To say as certain pundits do that nuclear power is still economical is like saying that driving a Rolls Royce is economical if you only count the cost of the gas. If you exclude the price of tune ups, the hard-to-obtain parts, the non-existent insurance and the specialized service.

The cost of nuclear power once touted as too cheap to meter has been historically underestimated by as much as 500 percent. In the case of Diablo Canyon and San Onofre this has been to the detriment of California ratepayers including the misdirection of ratepayer dollars that could have been better invested in exciting and truly renewable, truly sustainable forms of energy generation.

PG&E's own words our at least the words presented in their well-publicized and executed television campaign which I can't show you, tell us the future is wind, sun, water and other renewable energy. Why not rise to that challenge and create a future with 4,000 megawatts of golden opportunity? Again, thank you very much for inviting someone who represents the public and ratepayers to attend this meeting and speak today.

PRESIDING MEMBER PFANNENSTIEL: Thank you Ms. Becker. Are there questions? We have none, thank you very much for participating.

MR. McCLARY: And that is all of our speakers for this morning. It's past noon.

PRESIDING MEMBER PFANNENSTIEL: It is. I want to thank the morning panel. I'm sorry we ran so late but it was, it was worth it in my opinion. I think we built an incredibly strong record on these subjects. And we appreciate you who travelled a great distance to come and participate with us, very valuable information.

We're going to take a lunch break. And we are running late so let's come back in a little over an hour. It's twenty of one now. Let's come back at a quarter to two. So an hour and five minutes from now.

(Whereupon, the lunch recess was taken.)

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AFTERNOON SESSION

PRESIDING MEMBER PFANNENSTIEL: Good afternoon. I think we're ready to start up in the afternoon session. We have a number of impressive invited speakers so why don't I turn it over to Dr. Weisenmiller to get us going.

DR. WEISENMILLER: Good afternoon. Starting out on the last panel of our two day session. And as we have done in most of these we're starting out with a public official and our first speaker will be Richard Cheston from the US Government Accountability Office. He is the Assistant Director in GAO's Natural Resources and Environment team. His public service has been with GAO and as part of that he's worked on primarily energy and scientific issues. And he is currently responsible for engagements evaluating Yucca Mountain and the NRC's readiness to review license applications. And he is also responsible for their recent report on Key Challenges Remain for Developing and Deploying Advanced Energy Technologies. I think we have provided these three GAO reports to the Committee, the Commissioners.

MR. CHESTON: Good afternoon, Madame

Chairman and Commissioners. I am pleased to be here today to discuss the US Government Accountability Office's assessment of the key challenges to the development and deployment of nuclear power in the United States.

My remarks will summarize recent GAO assessments of the Department of Energy's efforts to, one, design and build a repository for the permanent storage of spent nuclear fuel and other radioactive waste at Yucca Mountain in Nevada, two, stimulate the deployment of Generation III nuclear power technologies, and three, conduct R&D designed to develop Generation IV technologies. I will also discuss the NRC's efforts to regulate 104 operating nuclear power reactors and prepare for license applications to build and operate as many as 29 new nuclear power reactors.

Turning first to DOE's efforts to build a nuclear waste repository at the Yucca Mountain site. Nuclear power reactors generate 20 percent of the nation's electricity but also create waste that can remain highly radioactive for hundreds of thousands of years and require proper disposal to protect public health and the environment. More than 50,000 metric tons of this radioactive waste, enough to fill the area of a football field about ten feet deep, currently is being stored temporarily at 72 sites around the country, principally at commercial nuclear power plants.

The Nuclear Waste Policy Act of 1982 directed DOE to construct an underground geologic repository to permanently store spent nuclear fuel and other radioactive waste. The act required nuclear power plants to contribute to the Nuclear Waste Fund to pay for the construction and operation of the nuclear waste repository and set 1998 as the target date for DOE to start accepting this waste.

Before construction of the repository can begin DOE's Office of Civilian Radioactive Waste must apply for and obtain a license from NRC. In June 2006 OCRWM's director announced an aggressive schedule to submit DOE's license application for a repository to NRC by June 30, 2008. OCRWM's director currently estimates that 2017 is the earliest date that the repository could open.

As apt of NRC's licensing process DOE must demonstrate its repository will meet NRC standards for protecting public health and the environment from hazardous exposure to radioactive waste. In preparation for submitting a license application OCRWM has conducted numerous scientific and technical studies at the Yucca Mountain site that will serve as supporting documentation to demonstrate that it can meet these standards.

OCRWM has also developed mathematical models to measure the probability that various combinations of natural and engineered features of the repository will safely contain the waste for the long term, taking into account water infiltration, earthquakes, volcanic action and other scenarios.

To ensure the reliability of the license applicants' technical analyses NRC requires them to implement a quality assurance program so that scientific analyses, design, engineering, procurement, record keeping and other work at the project are performed under controlled conditions that ensure quality and enable the work to be verified by others. Project teams are then responsible for carrying out aspects of the work and creating their own policies and procedures to implement the quality assurance requirements.

In March 2006 we reported that OCRWM had experienced persistent problems with its quality assurance program for the Yucca Mountain project. We concluded that the project's management tools were ineffective for monitoring performance and detecting a new quality assurance problems. We recommended that DOE take actions to strengthen the project's management tools to better identify problems and track progress in addressing them. The report also identified three substantial management challenges facing the project.

First, DOE faced challenges related to its 2005 discovery of email messages implying that some US Geological Survey employees who provided technical analysis for the Yucca Mountain project had falsified records for scientific work and had shown disdain for a quality assurance program requirements. Our subsequent report in January 2007 found that DOE had spent about $20.5 million on rework and training associated with the USGS work.

Second, DOE faced challenges in ensuring that specific engineering designs reflected high level plans and regulatory requirements. For example, a building for handling radioactive waste was required not to have any water, which could facilitate a nuclear reaction. However, the building was inadvertently designed with a fire suppression sprinkler system.

Third, DOE faces challenges with management continuity. For example, between 2001 and 2006 nine of seventeen key management positions experienced turnover. NRC has expressed concern about the need for continuity of qualified managers rather than a series of acting managers.

Quality assurance challenges are not new at the project and over time have contributed to delays in submitting a license application. In 2001 DOE determined that it would not be able to submit a license application to NRC by December 2002, in part because of ongoing efforts to resolve quality assurance problems. DOE was also unable to meet a December 2004 goal for submitting a license application.

In October 2005 DOE implemented its New Part Forward, which made major changes to the design, organization and management of the project by, for example, reorganizing project staff to create a single manager in charge of the project's main tasks in science, engineering and licensing.

Int also designated Sandia National Laboratories as the project's lead laboratory to integrate the scientific work previously being overseen by the project's lead contractor, Bechtel/SAIC Company.

More recently the director fundamentally changed DOE's management of the Yucca Mountain project. DOE now directly manages the project rather than its prior role that was limited to overseeing Bechtel/SAIC's implementation of its management and operating contract. The OCRWM director and deputy director now hold monthly program review meetings with DOE and contractor project managers and routinely participate in quality assurance management meetings with a focus on identifying and correcting problems.

Many states have expressed alarm at the delays in opening Yucca Mountain, fearing that the repository will suffer continual delays or might never open, forcing the nuclear power plants to store the spent fuel indefinitely. According to the National Council of State Legislatures, seven states have prohibited the construction of new nuclear power plants, citing the need to resolve the spent fuel issue.

While the states are concerned about

public health and environmental risks, especially with about 2,000 tons of spent nuclear fuel being added to the national inventory annual, DOE and NRC cite a long list of studies that indicate that the risk of radiation release from spent fuel in interim storage in pools or in dry storage casks is low.

Turning next to the additional challenges that electric power companies face in deciding whether to deploy Generation III reactors. In December 2006 we reported that the nuclear energy industry, DOE and NRC face important challenges in reinvigorating the nuclear power industry by building new, Generation III reactors. These challenges include the high capital costs of the nuclear power reactor construction projects, regulatory uncertainty that could delay construction that could substantially add to project costs, public resistance and the previously mentioned discussion on the uncertainty about the long-term storage of nuclear waste.

During the 1960s and '70s the costs and time frames of constructing many nuclear power plants vastly exceeded anticipated budgets and schedules. And in the late 1970s public concern grew about the safe operation of existing reactors.

NRC issued its last permit to construct a nuclear reactor in 1978, the year before the Three Mile Island nuclear reactor accident, which heightened public opposition to nuclear power and tightened NRC's oversight of nuclear power plant operations. Since then no electric power company has applied to NRC for a new, nuclear reactor construction permit. However, as of December 2006, of the 103 operating nuclear reactors in the United States, 43 have been approved for a 20 year license extension and another ten had submitted applications to NRC to extend their licenses.

Nuclear energy representatives expect that a new nuclear power plant could cost between $1.5 billion and $4 billion. More than double the cost of comparably sized, conventional coal-fired plants. These costs may increase if, one, transmission lines need to be installed or upgraded, two, significant delays occur during construction or start-up activities, or three, lawsuits are filed resulting in higher legal costs and delay.

Although nuclear power plants have

relatively low operating costs and can operate at 90 percent capacity, the overall cost of construction makes nuclear energy a high-cost option.

In recent years MIT and the University of Chicago issued studies comparing nuclear power's cost with other forms of generating electricity. Both studies concluded that assuming no unexpected costs or delays in licensing and construction, nuclear power is only marginally competitive with conventional coal and natural gas, and even them only if the nuclear power industry significantly reduces anticipated construction costs.

However, the MIT study found that if a tax on carbon emissions were introduced, nuclear energy could become much more competitive because conventional coal and natural gas power plants would be subject to the tax while nuclear reactors would not because they do not emit carbon dioxide during the generation of the electricity. Coal-based IGCC plants could perform much better than conventional coal-fired plants in capturing and sequestering carbon dioxide emissions. but these plants are considerably more expensive to build and operate than conventional coal-fired plants.

Because NRC has not issued a construction permit in almost 30 years investors worry that the problems that contributed to the schedule delays, cost overruns and abandonment of many plant reactors may not be resolved. For example, the Nuclear Energy Institute noted that some nuclear power plants that should have cost about $500 million at the time actually cost $1 billion and took several years longer than anticipated to build.

Among the reasons for these problems were that electric power utilities had custom-built many of the nuclear power plants rather than using a standard design, and sometimes began construction with preliminary design information, only to resort to mid-construction retrofits as final design plants changed.

In 1989 NRC streamlined its licensing process by contributing its -- by combining its construction and operating licenses into a single license that requires applicants to submit final design information, safety analyses and environmental data in advance of or with license application.

While industry representatives generally agree that the revised licensing process reduces risk of retrofits, they are concerned that the new process has not been tested and could lead to costly delays. For example, some representatives noted that NRC had already fallen behind schedule in reviewing early site permits for three electric power companies submitted, that thee companies had submitted as part of a DOE demonstration program to stimulate power companies to apply to NRC for a combined construction/operating license.

Electric power companies have notified NRC that they plan to submit license applications to build and operate 29 new reactors. To prepare NRC is implementing a design-centered approach requiring that applicants use standardized design for each reactor manufacturer with variations only to address the site's local characteristics such as environmental conditions.

NRC also has created a separate Office of New Reactors to oversee the licensing process, is hiring additional staff, and is developing a more robust system to handle electronic comments.

NRC initially announced its intent to issue a decision on each license application with

42 months after it was docketed. However, NRC announced on Monday that the Commission has approved a series of recommendations to reduce the length of the review process. While NRC has issued draft regulatory guidance for submitting and reviewing the combined license applications it has yet to finalize the guidance.

According to the nuclear energy industry, public support for nuclear power has increased in recent years, primarily as a result of the industry's improved safety record and a growing awareness that nuclear power production releases few greenhouse gases.

Many electric power companies plan to build new nuclear reactors at existing power plants, expecting to encounter less community resistance and to take advantage of existing power transmission lines and historic, environmental data for the required environmental assessment. However, industry officials acknowledge that the support is fragile and noted that a nuclear accident anywhere in the world could undermine this support.

Turning to DOE's nuclear energy R&D program. Historically, DOE's nuclear energy R&D

program peaked at $2.4 billion in real terms in fiscal year 1998 (sic) and then fell through fiscal year 1998 when the nuclear R&D program received no budget authority. Since 999, budget authority for nuclear energy R&D has gradually increased as DOE implemented a long-term agenda to develop more efficient and proliferation-resistant fuel cycles. devise technologies for managing nuclear waste and design a fourth generation of nuclear reactors that would not use conventional light water reactor technology. In fiscal year 2001 DOE prioritized its R&D program to focus on, one, the Nuclear Power 2010 program, two, the Advanced Fuel Cycle Initiative, and three, the so-called Generation IV Nuclear Energy Systems Initiative.

Finally, turning to NRC's reactor oversight process. NRC ensures the safety of the nation's 104 operating commercial nuclear power plants by issuing regulations, licensing and overseeing plants, and requiring necessary action to protect public health and safety, up to and including shutting down a plant if it is not meeting the licensing conditions and poses an undue risk to public health and safety.

Plant operators are responsible for safely operating their plants in accordance with their licenses.

NRC's new ROP process is similar to its prior process in that the oversight activities largely consist of fiscal plant inspections. However, the inspections now focus on more important safety issues. The unexpected discovery in March 2002 of the extensive corrosion and a pineapple-sized cavity in the reactor vessel head, one of the vital barriers preventing radioactive release at the Davis-Besse nuclear power plant in Ohio, led NRC to reexamine its safety oversight and other regulatory processes to determine how such corrosion could have been missed. NRC made several changes to the ROP based on the lessons learned from that event.

NRC uses various tools and takes a risk-informed and graded approach to ensuring the safety of nuclear power plants. The tools include physical inspections of plants' equipment and records, and quantitative measures or indicators of plant performance such as the number of unplanned reactor shutdowns. NRC uses a risk-informed approach. That is, is one that considers safety significance in selecting the equipment or operating procedures to be inspected to apply these tools.

NRC inspectors conduct baseline inspections of plant operations almost continuously at each nuclear power site. When NRC becomes aware of a performance problem at a plant it assigns the inspection finding one of four colors that reflect the finding's risk significance, which is set based on measures that reflect the potential health effects that could occur from radiological exposure.

For most serious inspection findings NRC conducts supplemental inspections to review the extent of the problem, the sufficiency of the licensee's evaluation of the root cause of the problem and the licensee's proposed corrective actions in response to the identified performance problem.

NRC conducts specific inspections to investigate specific safety incidents such as reactor shutdowns due to equipment failures because of their potential significance to safety. Based on the number and risk significance of inspection findings and performance indicators NRC places each plant into one of five oversight categories on its action matrix, which corresponds to graded or increasing levels of oversight.

From 2001 through September 2006 the ROP resulted in more than 4,000 inspection findings concerning nuclear power plant licensees' failure to fully comply with safe operating procedures. NRC subjected 79 of the 103 operating plants to increased oversight for varying amounts of time. Most of these plants received the lowest level of increased oversight, consisting of a supplemental inspection to follow-up on corrective actions taken for performance problems.

About 97 percent of the inspection findings were green, meaning that they were actions or failures NRC considered important to correct but of very low significance to overall safe plant operations. Of the other 98 inspection findings, 86 were white, meaning they were considered to be of low to moderate risk significance, while 12 were of the highest levels of significance to safety, either yellow or red. For example, a steam generator tube failed at one plant causing an increased risk of the release of radioactive material.

Over the past five years five plants have been subjected to the highest level of NRC oversight that still allows continued operations. Plants in this category were subjected to this higher oversight for long periods of time due to the more intensive supplemental inspections conducted by NRC and the more systemic nature of the plants' performance problems and subsequent corrective actions NRC expected the licensees to take.

NRC inspectors told us that when plant performance declines it is often the result of ineffective, corrective action program, problems related to human performance or complacent management. In assessing ROP results we found an association between poorer performing plants and deficiencies in the plants' human performance and problem identification and resolution programs.

One important shortcoming in the ROP that we and others have found is that it is not as effective as it could be in identifying and addressing early indications of deteriorating safety at nuclear power plants before problems develop. In response, NRC recently undertook a major initiative to improve its ability to address plants' safety culture. That is, the organizational characteristics that ensure that issues affecting nuclear plant safety receive the attention their significance warrants. NRC recently modified its oversight process by redefining and increasing its focus on cross-cutting safety issues and developing new requirements under the ROP to more directly assess safety culture at poorer performing plants.

We concluded that NRC's efforts to incorporate safety culture into the ROP may be its most critical future change. More than four years have passed since the Davis-Besse plant highlighted that a significant weakness in NRC's oversight was its inability to identify deteriorating safety conditions at plants before they resulted in a performance problem. NRC is taking concrete actions to begin incorporating safety culture into the ROP. It will be important to closely monitor this effort to ensure that it is achieving the result of objectively assessing safety culture while providing an early indication of declining safety performance.

We recommended that NRC aggressively monitor, evaluate, and if needed, implement additional measures to increase the effectiveness of its safety culture changes. We also recommended that NRC make available additional information on plants' safety culture to the public and its other stakeholders to provide a more comprehensive picture of plant performance.

Madame Chairman, this concludes my prepared statement. I would be happy to answer any questions that you or the Commissioners may have.

PRESIDING MEMBER PFANNENSTIEL: Thank you, Mr. Cheston. Are there questions? Commissioner Boyd.

COMMISSIONER BOYD: Thank you, Mr. Cheston. And I was just wondering, in your office's oversight of the NRC, and in the vein of these questions about culture and safety culture and trying to spur the injection of more concern about safety in the procedures and the activities of the office. I was just wondering if your office has had any observations on the culture within the NRC.

Before lunch we heard a presentation that was pretty strong with regard to the lack of adequate, let's say, culture within the NRC, and another speaker questioning whether we, we as an agency, we as a state, should rely as heavily as perhaps we have in the past on the NRC. I just wonder, do you have any thoughts or comments?

MR. CHESTON: We have not looked at that issue direction in our work. We have recently issued a report looking at human capital issues at NRC. NRC is experiencing a huge turnover of staff where a number of people have retired. In addition NRC is adding about another 1,000 people to their staff in preparation for the new reactor licensing.

I guess my basic reaction is with that much turnover it's a very important question to ensure, number one, that these folks receive the training that they need to. A lot of people are taking over new jobs within the office and have new responsibilities. In addition it's always good to have an outside review and a careful review to ensure that safety is occurring in the nuclear power field.

COMMISSIONER BOYD: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Any more questions? Commissioner Geesman.

ASSOCIATE MEMBER GEESMAN: Has your

office looked at the question of financial guarantees and the adequacy of those contained in the 2005 Energy Policy Act? Either to get an initial round of plants off the ground or perhaps even further out into the future to sustain an industry.

MR. CHESTON: We issued -- At the back of my statement I included a list of recent GAO reports and testimonies and two of them took a look broadly at the loan guarantee issue. There are separate concerns for the nuclear power area because my understanding was the Department was not going to guarantee the full cost, they were only going to guarantee, I can't remember if it was 90 percent of the cost. And the various nuclear industry folks said that would not be sufficient for them, that was too great a risk.

A second one is that the House Appropriations Committee has issued their report for the energy and water development appropriation. And in that my understanding is that nuclear would not be eligible for the guarantees this coming year.

ASSOCIATE MEMBER GEESMAN: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Other

questions? Thank you, Mr. Cheston. Very important information for us, thanks.

DR. WEISENMILLER: Next we're going to make an adjustment to the schedule and go with Jim Harding next. Jim has a flight he needs to catch so we need to get him out of here in about an hour. I'm sure his talk will be less than an hour but I think going through a couple of more between now and then is not going to work.

MR. HARDING: I might actually jump up and do it from here.

DR. WEISENMILLER: Okay. Just to do the introduction for Jim. One of the things to highlight is that Jim was a member of the recent Keystone Center's nuclear report and can talk particularly, I guess, on the economic issue. Obviously later we have Tom Cochran and Tom was actually on the steering committee of that report so between the two of them I think we can cover, they can cover just about any questions you might have on that.

In terms of Jim's background, again, trying to keep it simple. He was the director of external affairs and director of power planning and forecasting for Seattle City Light, which he assured me is even greener than PG&E in terms of kilowatt hours and associated greenhouse gas emissions.

He also had a number of opportunities in state service. At least some of us remember Jim when he was at the Energy Commission as advisor to two commissioners and ultimately in the Washington State Energy Office and with the Northwest Power Planning Council. Another period of time he was with MHB so he also has a consulting hat. And then as a public interest background he was with Friends of the Earth decades ago.

MR. HARDING: Yes.

DR. WEISENMILLER: So with that.

MR. HARDING: Thank you Bob.

DR. WEISENMILLER: Sure.

MR. HARDING: Back in those days Bob and I worked for the same commissioner as it turned out. It's a pleasure to be back here and see so many old friends and faces and also to talk a little bit about what has become a much more popular topic these days than it was a few years ago when you last held a hearing on nuclear power.

I am indeed going to talk about much of the work that went into the economics part of the

Keystone Center report. And for those of you who don't know, the Keystone Center has a history that goes back to the mid-70s, that some of their first work was on the nuclear fuel cycle. And the way they approach issues is to bring people of strongly held but varying opinions together in a room to see whether they can write anything together.

And initially we did a series of reports on the back end of the nuclear fuel cycle in the '70s that were weekend activities and we'd get a letter out to Frank Press, the president's science advisor, by Monday. I found it a very useful approach at that time. It beats the alternative of people sparring with each other using words they look up in the thesaurus the day before.

It is helpful to have NRDC, Southern Company, GE, Friends of the Earth if necessary, on the same document, even if the document is nuanced. And the Keystone Report is at various points nuanced. But we did try to take a pretty close look at this question as well as --

We started with the basic reason why we were here. It was driven a little bit by, driven for the most part by persistently higher fossil fuel prices, growth in demand for electricity and carbon.

And many of you are familiar with the recent paper by Rob Socolow and his colleague. They were proposing that the world over the course of the next 50 years needs to find a way to avoid seven gigatons of carbon emissions annually. They looked at 15 different ways that one might get to a gigaton, seven of which are needed to stabilize atmospheric concentrations of CO2 at about twice pre-industrial levels. One of those was nuclear.

A nuclear wedge was about 700 power plants, we have 370 worldwide. So we need to build 1,070 reactors over the next 50 years or about 21 a year. Along with lots of new uranium enrichment plants, repositories, maybe reprocessing plants. Can that happen at all and can it happen without weapons proliferation was one of our questions.

This is the picture worldwide on retirements. Some of this is without life extension and some of it is driven by statutory requirements in Western Europe. But as you can see the pace, we don't see it right now but the pace picks up pretty quickly by the mid-2020s. It can be pushed out a bit but I think you'd still see that most of the 370, all the 370 retired over the next 50 years.

There are some forecasts, nobody forecasts electricity demand or nuclear power out to 2050, it's way too far. But some people tried to do it for 2030. As you can see the two main forecasts that I've looked at are the Energy Information Administration and the International Energy Agency. Both have -- they both to some extent rely on each other. But as you can see, net additions between now and 2030 are well short of that ace of 21 gigawatts per year. And indeed in terms of fraction of the world's electricity it's not a great deal. It doesn't change much between now and 2030.

The last column is a fairly interesting one, which is the fraction of the net additions, additions above existing capacity, that occur outside of the OECD, including OECD Japan and Korea and Russia. So you could alternatively label that China, India, et cetera. If you're going to see expansion that is where it is going to happen.

So I think two to six is a credible

number. I think it's within the capacity of the existing industry but well below what is necessary to get toward a wedge. And as I said before, even with roughly 75 to 100 percent of the net capacity additions occurring outside of the essentially developed world, nuclear power still is just keeping pace with electricity growth in India and China where it is growing the fastest.

The other countries you could think about, some of them raise concerns as to the associated fuel cycle facilities that would support their needs.

So now I am going to jump from proliferation which isn't really, which might be an issue for you but not within the Warren-Alquist Act, to reactor economics and how we start to think about what a new reactor might cost in the United States.

The past is of no assistance. We built some reactors in the early '70s relatively cheaply, we built quite a few in the late '80s that were extraordinarily expensive and the spread was a factor of three. So there are many reasons for this story and each dot has its own story to tell.

You've heard before, we mis-estimated badly, regardless of what year you did the estimate.

And I think today we're mis-estimating badly. You can look at 13 studies, as we did in the first phase of the Keystone Report, knock out the outliers, average the rest and come up with a lousy number. We started in a different -- We approached this problem differently and I think our report is consistent, has a much higher number. A factor of two to three higher than the studies. But it is also consistent with recent conclusions, very recent conclusions of both Standard and Poor's and Florida Power & Light.

And the main -- We started with the only place you can go to look for recent experience is Asia. We haven't built anything. There's no database outside of Asia. So if you looked at the recently completed standardized reactors in Japan and South Korea you get a number that starts -- This is in the range of $3,000 per kilowatt. Overnight costs. That's as if you could start today, finish tomorrow.

This is actually the basis. The first column in 2002 dollars is exactly where the MIT study started. So they essentially did this same exercise and published their report in 2003. But we've had some changes since 2003. After many years of fairly flat or basically zero escalation in materials and equipment that curve is about five percent real per year since 2002.

It is not specific to the nuclear industry and it affects all generation technologies, but capital intensive ones the most. Spread over a longer period of time you can see that that curve is steeper than we had in the mid-70s and the mid-70s when escalation in nuclear construction costs was most acute. I think that's at 7.4 nominal, which would be what, 4.7 real.

In addition to that general problem, which some people call the China Effect, higher steel, concrete, zinc, copper prices, we have some specific issues with the nuclear industry that I think are going to be difficult to get around.

The industry has been moribund in the US, Western Europe and Russia since TMI and Chernobyl, at least with respect to new construction. So crews, contractors, sub suppliers, forging capacity. Making the large equipment isn't going to happen in the US, we have to go abroad for that. Quality control, inspections by the NRC. It's going to be harder to do.

And this last one surprised me quite a bit. Uranium production is currently about 60 percent of western uranium demand. And I'll go into that. I'll try to keep it short and sweet but it's complicated. Most products you produce about as much as you consume.

So what we did in Keystone to get to our numbers was to take the Asian numbers, assume four percent real from 2002 to bring us to 2007.

Standard rate-based treatment but our best advice was that Wall Street would exact some risk premium on equity.

Reasonably high capacity factor.

Higher fuel costs, three to four times current levels.

And you get a number that looks like $4,000 a kilowatt in 2007 dollars, which is entirely consistent with the S&P findings but a factor of three higher than the studies.

Capital isn't the only factor. These are not Keystone numbers, these are my numbers. The Keystone numbers are 8 and 11 but they are in most respects pretty close. Eight to 11, 9 to 12. This is not an inexpensive proposition to build and operate a new reactor over its lifetime.

Okay, the strange market. This market actually reminds me a great deal of the California electricity market a couple of years ago. The primary supply of uranium is that first red bar, which means how much actually we dig up out of the group. And then the first, what should I call that, turquoise bar is how much enrichment capacity we have worldwide.

This thing called secondary supply. I probably shouldn't use that, it won't speed me up. The secondary supply is associated with first of all utilities that bought uranium well in advance but cancelled their plant after TMI. The same thing happened in Europe after Chernobyl, both in Russia and Western Europe.

Finally we privatized enrichment capacity and associated inventories in the US and currently about 50 percent of our electricity in the United States is produced by blended down surplus weapons uranium.

So all of those things go away and they go away in a hurry. Roughly by 2013. And to meet the demand of the current worldwide industry you need to find some combination of uranium supply and enrichment that gets you to the green lines. So we're looking at needing to double both of these actually quite soon.

That's just a graph of -- We used to produce a lot of uranium, partly for weapons and requirements are now well above worldwide production.

It's been a volatile market. This chart was done in October of last year. Prices in early June, that last little red number, are at 135, which is getting close to off the chart.

I don't know if I want to even want to talk about this. But the problem gets worse if you try to build lots more reactors. No surprise.

Currently we're not seeing the effect of higher uranium prices in PG&E's rates or in EIA figures, for this reason. Uranium that is burned in 2007 was actually bought in 2002. It takes four years to get from either in physical turns or in lead time, physical lead time for mining, convert milling, conversion US-6, enriching, reconversion, fuel fabrication, ship it to the reactor.

In that time -- So people burning at SONGS probably spent $15 on their uranium. When it gets to the reactor the only thing that's happened to that $15 is it's increased because of inventory charges. Essentially interest. It's capitalized. But utilities in mass are going to have to enter this market in the next couple of years in order to meet their requirements four years from today.

I just came back. I was in Singapore giving a very similar presentation to Rio Tinto, which is the second-largest uranium mining company. And they found this interesting but you won't. (Laughter).

When uranium prices skyrocket and supplies get tight it is very common for people to start talking again about reprocessing of nuclear fuel. MIT looked at this question with very inexpensive uranium prices and inexpensive enrichment prices. I looked at this question both in the context of the Keystone report and using more recent numbers.

Yeah, nuclear fuel cycle costs are three to four times higher than you will see reflected in almost any study, assuming those costs stick around for awhile and I think they will. But they are still a factor of two to three lower than you would if you closed the cycle with reprocessing. I think that reprocessing number, by the way, is pretty low. So it is an uneconomic choice with many other liabilities in terms of waste management and non-proliferation resistance.

This is another bad one. You should actually close your eyes to the last line. This is what the recent Standard & Poor's report said about the cost of new generation. And the coal numbers reflect recent escalation, they're a lot higher than I would have used a few years ago in the utility business.

What they also tell you is that nuclear power doesn't look particularly attractive just based on internal costs compared to those resources. If you force new generation to actually capture and sequester carbon that makes life impossible for pulverized coal. Although I am going to tell you, I think their carbon capture number is about two times to high, at least for pulverized coal. That number should ultimately be in the two to three cents a kilowatt hour, maybe even less. What it also tells you is that --

That line is if you have to sequester. And I'm certainly going to pick wind if I have it. And maybe nuclear but it's not compelling. It might also be true that your choice on either of these rows may be driven by transmission more than the difference between the cost of generation.

Finally, if you tax carbon rather than require sequestration, or can buy credits, you will build these fossil resources before you build reactors. The reason for that is just that the sequestration cost is not only cost per kilowatt but it is serious parasitic use of electricity. It is higher than $30 a ton. That's just a shortcut.

MR. WILLIAMS (FROM THE AUDIENCE): What was your natural gas cost?

MR. HARDING: $7 a million. I don't know if that's high or not. If you build lots of combined cycles it's probably low.

I think S&P's estimates for carbon capture are on the high side, as I say here. International Energy Agency estimates are two to three rather than three to six. And with about 15 technologies available they see that dropping somewhat.

And as I say here, pulverized coal is cheap, although the transmission, I can assure you the transmission is not.

Wind, as I think everybody on the west coast knows, is the cheapest marginal resource, even though wind prices have escalated dramatically.

Gas is not out of the picture, even at seven.

And if carbon is taxed rather than sequestration, if capture and sequestration is required you'd probably end up at least in the near-term buying the credits or paying the tax rather than doing sequestration.

And with that I'm done and happy to answer questions.

PRESIDING MEMBER PFANNENSTIEL: Questions? Commissioner Geesman.

ASSOCIATE MEMBER GEESMAN: Jim, it's good to see you again. We should have more of these hearings. I note that each time you show up you look younger but Weisenmiller and I seem to have put on more gray hair.

MR. HARDING: And as I recall you replaced me in my position.

ASSOCIATE MEMBER GEESMAN: Yes, we all worked for that same commissioner.

We had a hearing earlier this week, Alan Hanson was here from AREVA. I asked him about the Keystone group. He said that you guys generally tended to embrace watered-down conclusions as a result of the consensus process and that you had ignored all of his advice. I am not going to ask you whether that's right or not.

MR. HARDING: We listened very closely.

ASSOCIATE MEMBER GEESMAN: I note though -- The executive summary of the report was made available to us in our background materials. I note that one of the things that was said was that the joint fact finding group concludes that while some companies have announced their intentions to build merchant nuclear power plants it will likely be easier to finance nuclear power in states where the costs are included in the rate base with a regulated return on equity. I wonder, as an individual participant in the process, do you agree with that?

MR. HARDING: Yes, very much so. And actually your consultant report hits this point quite well. In fact, much better than we did in the body of the report. I would also say that when you look at the executive summary you really do get the watered down version because findings are what people really struggled with. As one of my friends often says, and we relied upon, every public policy problem in the world can be solved with increased ambiguity. So that's where we went. I think the body of the report is a much more interesting read.

ASSOCIATE MEMBER GEESMAN: Your capital cost assumptions I presume are financed capital costs instead of the so-called overnight capital costs?

MR. HARDING: The $4,000 per kilowatt, the difference between the $3,000 overnight and the $4,000 is real interest and escalation during construction. So it is completed in the year 2012 and then all of those costs are brought back to 2007 dollars. So yes.

ASSOCIATE MEMBER GEESMAN: So that assumes no or negligible construction schedule overrun.

MR. HARDING: Correct. I think we're being pretty generous. We assumed a five to six year construction period. In our low case we assumed, -- My dear friend Paul Genoa from the Nuclear Energy Institute asked me to run four but the low case had no real escalation in it so it doesn't matter whether you do it four or five, it's the same number.

ASSOCIATE MEMBER GEESMAN: What was your real interest rate assumption?

MR. HARDING: It was 15 percent return on equity, 50/50 debt equity, eight percent debt. My guess is that's probably close to eight percent real. It's probably less than that weighted after tax cost to capital. I can't do the number in my head but I'd be happy to provide the Commission the number.

ASSOCIATE MEMBER GEESMAN: If you would send that to us for our record. I also note from the executive summary, We agree that the most recent construction experience is the best indicator of future costs. Then you did comment about the vintage of a lot of our construction assumptions. I didn't hear any reference to the AREVA project in Finland. I wonder if you've got a view on that?

MR. HARDING: Yes. We would have liked to use data from the Olkiluoto 3 project that's underway. The project is not done. AREVA has encountered significant delays and they blame several factors. Most recently they said they underestimated the supply chain challenges, skilled contractors and crews. They've got, evidently, 27 languages to deal with on the site.

ASSOCIATE MEMBER GEESMAN: It sounds like the Los Angeles Unified School District. (Laughter).

MR. HARDING: They have had a rocky relationship with the Finnish regulator and they, themselves have said they were less-advanced on design before they started building. And I found interesting that a lot of people will say, we're not going to do that again. But when it gets down to the real world, both the Finnish regulator and AREVA said, it's not realistic to expect a vendor to develop a full set of construction plans before you start the project. It's not going to happen. It takes too much money and time. Even for a standardized plant.

So they're about a year and a half behind schedule and they have told the French equivalent of Wall Street that they will not make money on this, and estimate their loss at between

$700 million and a billion. Which is a tough for a vendor to deal with. A utility, PG&E could handle that, but a vendor doesn't have the pockets to do that. So we don't know what the final cost is going to be, that's only AREVA's fraction. There are other parties such as the utility itself that could also be seeing overruns.

ASSOCIATE MEMBER GEESMAN: Thank you very much.

PRESIDING MEMBER PFANNENSTIEL: Jim, I have a couple of kind of small points just in your analysis. You talked about just using the Japanese experience and not as you were just discussing, others. Any French plants come on during that time?

MR. HARDING: No. There is one -- After AREVA gets done on Olkiluoto they will start on Flamanville 3, which will be another data point. But alas there just isn't very much out there.

PRESIDING MEMBER PFANNENSTIEL: And then you talked about the construction costs spiking in recent years since 2002 and you talked about how much greater those were than say the mid-80s when we had such a big run-up in nuclear costs. But as I remember, and I do remember, in the mid-80s interest rates were real high then and those big capital intensive projects like nuclear power were hammered by high interest rates and we don't have that. That must be somewhat offsetting in terms of the comparison of the costs then and the costs now.

MR. HARDING: Correct.

PRESIDING MEMBER PFANNENSTIEL: But not very much is what you're --

MR. HARDING: Well, we don't really know what the curve looks like for the components of the nuclear reactor. This is sort of chemical plant stuff, refineries. So we don't have an index from 2002 to 2007 that would really represent the basket of things that a reactor builder might want to buy. It's the best that EPRI could give us and it isn't very good.

It's a challenge to try to come up with the right approach going forward. In our low case we assumed zero real escalation going forward. In our high case we assumed about four. But I would be real uncomfortable saying that either of those numbers is even -- I'm not that comfortable with any of the numbers that we started with, let alone the ones that we escalate to. It's challenging without having much recent, real stuff to go on.

But I am pleased to see that we didn't get, we had lots of utilities on this panel. None of them disagreed with the numbers we produced. Florida Power & Light, operating completely independently produced similar numbers and I never talked to the guy at S&P until I saw his report last month. So I think we're in the ballpark.

PRESIDING MEMBER PFANNENSTIEL: Yes, it seems to me that it really does seem to be ballpark. Thank you.

MR. HARDING: But ballpark is the right word.

PRESIDING MEMBER PFANNENSTIEL: Yes. I'm not sure which ballpark. Any other questions?

COMMISSIONER BOYD: I just want to make a comment. I just want to thank Mr. Harding for -- and actually Mr. Cheston actually broached costs. We hadn't had much cost discussion today. But I wanted to particularly thank Mr. Harding, who I don't know from the past, not being a long-time alumni of this organization, for this dose of cold reality in terms of cost.

Because I do remember when we did the 2005 IEPR and some of the questions we left on the table that besides the heavy concentration of, we don't have fuel storage solved, the cost. The absolute uncertainty and inaccuracy of cost was an issue then and it obviously remains an issue today in terms of trying to determine the life cycle benefits of multiple energy strategies. The cost in this arena has always been a puzzlement, so thank you very much.

DR. WEISENMILLER: We'll now go back to the order that we had the agenda on. Our next speaker will be Professor Fthenakis, who is a senior chemical engineer with Brookhaven National Laboratory and a professor of earth and environmental engineering at Columbia University

At Brookhaven he leads the national photovoltaic environmental health and safety research center operating under the auspices of DOE since 1982. And at Columbia he founded and directs the Center for Life Cycle Analysis.

DR. FTHENAKIS: Thank you, Bob, for the introduction. Good afternoon, Madame Chair Commissioner, Commissioners, distinguished panelists, fellow citizens. I am honored to be here. And I am also very pleased to have escaped the storm, we had a storm in New York City yesterday, and arrive in the beautiful and sunny city of Sacramento early this morning instead of 11 o'clock last night as was scheduled. (Laughter). I am very, very pleased to be here.

As Bob mentioned I direct at Brookhaven National Lab the Center for Photovoltaic Environmental Health and Safety Research under the auspices of the Department of Energy and at Columbia I teach air pollution prevention control. Most of my work has been on air pollution prevention controls and solar systems. Environmental-related work. So not nuclear. My knowledge of the nuclear fuel cycle, it springs from my comparisons of nuclear with solar. So admittedly it is not very extensive.

But nevertheless I think that I can really give some feedback to this audience related to at least three questions. I will answer at the minimum three questions. One is, what are the real greenhouse gas emissions from the nuclear fuel cycle? The numbers are all over the place. So I think I can give an authoritative answer, especially for the US nuclear fuel cycle. What are the real greenhouse gas emissions.

Two, what are the accidental risks

related, the quantifiable, accidental risks. Because they are risks that we cannot really quantify. We don't know how to quantify in the nuclear fuel cycle.

And three, in view of the increased support of nuclear power as a carbon-free or low-carbon technology I will try to answer the question, is it really, as some other panelists will argue, the only technology, low-carbon technology that has the potential to satisfy all our energy needs.

Now with this in mind let's start with the nuclear fuel cycle. You are all familiar with it. The cycle starts by mining/milling the ores from the ground. Then we have the conversion, enrichment. The conversion into fuel, into uranium oxide in the fuel fabrication. And along with the construction and the operation of the nuclear power plant the reprocessing in some countries. We produce electricity, eventually waste disposal.

Now we don't have direct emissions or greenhouse gases during operation unless we use diesel generators for start-up. So most of the emissions are indirect. Emissions in each of those stages from the production of the materials. Fuel goes into the production of the materials. And also from the kind of dirty, quote/unquote, electricity above-ground that is used in all of these stages.

So we will be looking into those stages one by one and we will be quantifying the inputs and outputs in terms of materials and energy and the outputs in terms of emissions, and we link those to greenhouse gas emissions. So we have indirect emissions from carbon dioxide and some other greenhouse gases in each of these stages because primarily of fossil fuels used in the production of the materials and the above-ground electricity.

Now the numbers, as I mentioned, are all over the chart. You can see here before we embarked on our own analysis we looked at numbers in the literature. And you can see here a range from a low in Sweden, as wonderful as the Swedish utility of 3.5 grams of carbon dioxide equivalent, all the way to 100. So a factor of 30 here between the low estimate and the high estimate. The only estimate that corresponds to the United States is the old Argonne study by DeLucchi, now at University of California at Davis, which is a relatively high number of 70.

I am going to point you to actually three or four issues here. The big range here in the estimates is caused by either different assumptions in the enrichment stage, different technologies, diffusion versus centrifuge, and different methodologies and different background, electricity mixtures in different countries. So it is a country-specific exercise.

Now the big difference is here. Actually the big estimates in the high number by World, actually Storm and Smith, they are resulting form a different methodology that I will highlight later.

Let's look at in more detail the breakdown actually of the greenhouse gas emissions and the differences resulting from different enrichment scenarios. As you know, gaseous diffusion, actually it takes a lot of energy, about 2,400 to 3,000 SW used. And the centrifuge, about 40 times less energy. And this corresponds to almost proportionately high or low greenhouse gas emissions. So the fraction of the diffusion to centrifuge makes a big difference.

In the best case here, in Vattenfall, it actually combines a big fraction of centrifuge, 80 percent, and also diffusion from France that is powered 100 percent by nuclear. So it is kind of a carbon-free diffusion and mostly centrifuge.

Now the big number here actually includes an enrichment, a big fraction of some kind of dirty centrifuge. The United States, as I will highlight later, it changes, it changes per year. But in old years we used actually to power our Paducah, Kentucky plant with coal. In 2005 it was about 20 percent coal and about 80 percent from Tennessee Valley Authority. That is also a more coal-intensive mixture than the other US.

Again, so this is actually one reason for the big differences. The diffusion versus centrifuge mixture. Also background electricity, as I mentioned before. In Sweden and Switzerland we have rather carbon-free background mixtures, it's mostly hydro and nuclear. In Sweden it's about 95 percent, in Switzerland it's 97 percent. So that reflects in greenhouse gas emissions and that's why we have the very low numbers here in Sweden and the low numbers in Switzerland.

Now our analysis. As I mentioned, the

only analysis of the US nuclear fuel cycle was DeLucchi's in 1999. Comprehensive at its time but outdated now. So we started, we embarked on a new analysis and those are our assumptions. You can see here reactor lifetime we assumed 40. Burn-up. This enrichment mixture is a five-year average, 1998 to 2002.

We produced our study in 2005 and we didn't have the latest 2006 and 2007 numbers. But we did an update of these numbers and we'll present it later. So those are our assumptions related to other parameters and they are all influential.

This is our reference case. We thought an adverse case and this is our best case because there is some uncertainty in the input data. I am going to highlight the differences in our assumptions related to the ore concentration, They are all real cases here. We are assuming a reference point of two percent uranium, and in our best that we get ore from Canada, very high concentration of uranium, and in our worst that we get it from our other friend, Australian, .005 percent.

And there will be a difference that I

will highlight later on the estimate that is produced by the different methodology . The basic methodology that we use is process based but we also use economic input output. That is the methodology, that I will point out later, is expected to over-estimate emissions. And that is the methodology that was used by Storm and Smith in their high number global case.

So those are the emissions that we obtained according to the assumptions that I listed earlier that correspond to real conditions in the US cycle. And you can see in our reference case we determined that the greenhouse gas emissions, as given by carbon dioxide equivalent in units per kilowatt hour it's about 24 and we have a range from about 17 to about 55 so a ratio of three. A good improvement from the previous uncertainty. Obviously this relates to the US cycle and the previous numbers that had a divergence of a factor of 30, they were taking into account different conditions in different countries. So for the US we believe that this is a good reference.

Let's see, what else this graph shows. You can see the difference in the mining, in the emissions related to the mining. From our reference case to our maximum impacts case here we have .2 percent uranium, here we have .005 percent uranium. So the more we dig into dilute ores the more greenhouse gas emissions we expect to generate. Obviously because it is a more energy-intensive process.

And there is at the maximum, there is the limit at which we cannot really extract uranium energy cost-effectively. And there is a debate of what is that limit so I am not going to enter into this discussion. But it is good to know that the more we use uranium the more energy intensive really the process becomes and the more greenhouse gas emissions we may generate.

Here we have in the blue the enrichment base, the greenhouse gas emissions, that they are constant in this exercise because we assume the constant 1998 to '02 EIEA mixture. You can see the differences here in the operation stage between our reference and our maximum case because we assumed -- actually we use different methodology in the operations and construction. So you can see the big differences here in the construction. This is process-based, this is input/output economic analysis based.

This is an update of our data. Actually of our analysis. It is not published yet. What we published was the 2005 result that corresponds to the new enrichment reality in the United States. It changes over the years. But now in the last five years actually we have 12 percent local enrichment versus 34 percent in previous years. So we have kind of a cleaner enrichment than before and or reference case becomes actually 17 from 24 with the newer data. So you can see the impact of the enrichment as it changes from a period to another period.

Now going back into our estimates and the estimates of others. You can see a compilation of all the estimates here. Our estimates for the US cycle, they are given with this bright green. In enrichment we are actually in agreement more or less with most other people. This big difference here in Australia is based on 100 percent enrichment in the United States so very dirty enrichment. In our case we have the actual enrichment mixture that is only in this case 34 percent US based on the Paducah, Kentucky.

The Australian case here, the Australian study, it was published after we published our study and actually cites our study. Their numbers, their numbers correspond to ours in terms of enrichment. They have much bigger numbers though in construction and operation because they use a different method. This is the IECA Sydney Study, a very comprehensive study, and transparent study, but they use economic input/output instead of process-based analysis.

Now what is the difference? I think this example will highlight the impact of different methodologies. Process based. In the process-based we are just looking into detailed material and energy inventories in each stage. So we know we get from the industry, from the manufacturers what exactly are the materials used in each stage. What are the fuel used, what are the outputs in terms of waste, in terms of emissions and what are the energy emissions. And then we relate those to greenhouse gas emissions.

in the economic input/output analysis we'd be using emission factors related to different economic inputs and there will be different categories that relate dollars spent with emissions.

Now to the degree that one or the other they are very detailed you would expect correspondingly high or low accuracy. But in the economic input/output analysis we don't really have many details many times. In our case we use the Carnegie/Mellons EI/O database and they didn't have any categories specific for nuclear power plants. We used the general building and manufacturing category. Storm used a different database and the folks in Sydney used a different database. They are all actually pretty much based on similar emission factors.

Then you can see that the department point is the construction costs. So this construction cost is the overnight cost. As Jim looked at earlier, there is a big divergence in terms of construction overnight costs. Our case here, 4.5, is based on the Oakridge number 3.3 in 1989. And with inflation we actually determined that this is a good number.

The Sydney group's number is very, very low. By the way, this corresponds to $4,500 per kilowatt hour. This corresponds to $1,300 per kilowatt. And you can see the big differences. In our study when we used process-based we get one gram of carbon dioxide a kilowatt hour. In our worst study when we used economic input/output we got an 11 times bigger number.

Now we know from this exercise and from many other exercises we did on the solar electric cycle that the economic input/output would likely overestimate. Now the process-based LCA may slightly underestimate also. It all depends on the degree of the aggregation of the data. I am not going, really, to spend more time on this debate, what is actually the degree of over-estimation or under-estimation.

But I think that everybody will agree that if we use a life-cycle analysis method to compare different technologies we should use the same one in order to have well balanced, well-balanced comparisons. In view of the differences that the different methodologies may give us we should use the same methodology.

So we limit our comparison to process-based and this is the picture that we believe is actually the most comprehensive, the most accurate picture. These estimates here on greenhouse gas emissions from coal, natural gas and petroleum, they are all based on process-based data, they are not based on economic input/output.

So you expect that you will see that most of the emissions happen during operations. When we burn the fossil fuel the carbon content of the fuel gets into -- converts into carbon dioxide and goes into the atmosphere. So we believe that in this context the high numbers by Storm and Smith, for example, they are irrelevant because they are based on economic input/output and they do not really correlate with estimates on other technologies.

Now these are our estimates based on a very comprehensive detailed analysis of photovoltaics so you can see that nuclear and the photovoltaics, they emit minor greenhouse gas emissions in relation to the ones by each of the major fossil fuel cycles.

Now these numbers, obviously they change. They change depending on the change of the input data. For example, I showed that by using the newest enrichment mixture in the United States 24 has become 17 already. Now this number, it was much higher, much higher up to three or four years ago. You will see values for photovoltaics as high as 50 and they were based on all the dated prototypes, they don't really reflect the current reality. And this number, the 206 number has changed already.

Now when we're talking about solar electric we have always to give the background in terms of what is the sort of input. This corresponds to US average. That's 1800 kilowatt hours per square meter per year. For the southwest the number is already, is 17. The southwest average is 2150 kilowatt hours square meters per year, this is 17. This is for a ground-mounted utility application. For a rooftop where you get the synergy between the building material and the PV material the number is 20.

This corresponds to nine percent modiums. The same company that was manufacturing nine percent modiums in 2006 now increased their efficiency to ten percent. For cost, that by 2010 the efficiency will be 12 percent. So it's a dynamic process. And especially, especially as it relates to solar electric. The numbers are expected to become much lower if in the US cycle, if in the nuclear US cycle we use 100 percent centrifuge this number is going to become 12.

So that gives you an understanding of

what are the dynamics and a perspective of what would be the greenhouse gas emissions in the future. We don't expect reductions here. Not from what we know. But we do expect reductions in the nuclear and the solar electric fuel cycles.

Now let me change gears and try very briefly to give some highlights on our work on quantifying accidental risks. Together with colleagues at the European Commission's Joint Research Center in the Netherlands we have defined this framework where we're looking into risks according to three different categories.

Normal operation. This many times overlaps with sustainability criteria so we're looking actually at emissions of greenhouse gases as described earlier and the emissions of toxic gases and the emissions of heavy gases and materials input/outputs and occupational statistics, occupational safety statistics in terms of how many people get injured during a work week.

According to this actually metric -- In this category we don't expect very big differences in different fuel cycles with the exception of risks related to air pollution from coal, obviously.

Now we spent some time on quantifying accidental risks and we try also, are still trying to quantify this category that relates to perhaps increased likelihood of nuclear proliferation, military conflicts. Perhaps, perhaps releases from a permanent nuclear waste repository 2,000 years in the future. We haven't really progressed very much in this category so I am not going to present anything on this.

But with this balance I wanted really to project the underlying, here, rationale. That we have always to balance risks and benefits. A modern society needs electricity. Now, of course, with the production of electricity there are some risks and we need to see how to quantify those risks and what will be the associated risks and benefits.

So one metric, there are accidental risks per event. And you can here the numbers that are produced by the Paul Scherrer Institute people in Switzerland. This is a logarithmic scale. Events per gigawatt/year. So it normalizes events. Events are classified as either fatalities or injuries per energy output.

And you can see here, this is nuclear without Chernobyl, no fatalities for this period, '69 to 2000, 30 years. And this is with Chernobyl. And you can see here that according to this metric nuclear is safer than all the coal cycles, even with Chernobyl. Now they have a number here for photovoltaics that is not recommended by any data. They admit that is based on some expert opinion.

This is our number for photovoltaics based on EPA R&P data. We used nine-year data on real statistics, submissions of risk management programs. We have 14,000 companies in the United States that submit to the EPA anything that relates to accidents and those are the numbers we get for photovoltaics. They do not relate to actual incidents for photovoltaics but they relate to incidents in the production of materials that are used in photovoltaics. Anyway, this is only highlight. I don't have time to go very much in detail into this.

Another metric related to maximum consequences per single accident. And those are the Paul Scherrer Institute numbers again. Some may argue that their numbers with Chernobyl are high. Actually the UN numbers I think are lower. Nevertheless, here you can see, for example, in Africa, in Zimbabwe in mining, here you can see -- this goes further back than 1969, it goes to perhaps 1950. This is the explosion in a refinery in the Philippines and here you have an explosion and subsequent consequences in Russia. This is Chernobyl. This is another accident in 1957 in the ex-USSR.

This is the number they have for photovoltaics based on expert analysis, expert opinion, it is not quantifiable. They are going to change it now. In the next report they are going to use our number, they agreed, because our number is based on actual data. And there hasn't been any fatalities in the PV manufacturing side but this correlates to the production of hydrogen and the silicone trichloride that are used as feed stocks in the production of metallurgical grade silicone.

Now what is the underlying question here? Every technology has some risks. Of course as a society we have to question ourselves, what are the risks that we should accept and how to go forward. Some will argue that the nuclear energy is the way to both satisfy our energy needs in view of the fossil fuels being depleted and of the greenhouse gas emissions, that they perhaps have reached a dangerous level. Others will argue that coal with carbon dioxide capture and carbon sequestration is the solution. Others will argue that renewables is the solution.

Now each of these scenarios will have their cons. So for example, in talking about spent fuel management. We don't know how to go about proliferation risks.

Coal with carbon sequestration. I will put a big question mark in the technical feasibility. We don't know if it is feasible yet. Even if we have one percent leaks per year with 100 times -- actually residence time of carbon dioxide in the atmosphere. We don't do very much.

Then we have the residual pollution, even when we have specificators and baghouse equipment working at the 99.8 percent efficiencies still we have problem. I mean, coal is never completely clean. Things escape through the pollution control equipment.

Wind, as Tim mentioned before, it's already cost, actually collective. But we have resource limits. We don't have more than a few terrawatt of wind all over the world. And we have the problem with intermittency.

Solar, we think that it is high cost and obviously we have the initial intermittency.

Now our view of each of these options will determine what really we think about the prospect of each of those. And I'm very briefly going to allude on the President's Advanced Energy Initiative where all three pathways are being pursued with new investments, clean coal, nuclear power, renewable solar and wind energy.

And the secretary of the department believes in diversification. Obviously diversification, it also makes us think of how, what will be the degree of the diversification. Let's say from 20 percent nuclear it's easy to think about getting to the 40 percent or 60 percent. From .3 percent solar is perhaps more difficult to envision that we can get to 30 and 60 percent, 100 percent solar.

But I will put my money on, as Thomas Edison said, on solar. And I am going just to give you a highlight of work in progress that our group, my group at Brookhaven is conducting related to the prospect of solar.

Before I do that. These are the projections of the Department of Energy, the Solar America Initiative, which is a part of the President's Advanced Energy Initiative. Those are the prices now. For the southwest, where we have most of -- we have the highest sort of potential with the price about 18 cents per kilowatt hour. For the northern state about 35. The department believes that with incentives that have been already in place the price can be competitive with the utility rates by 2015.

We believe, my group, and these are my personal views, we believe that it will take a little longer. That it will take to 2020. But we do believe that the implementation can be much higher than what the department thinks. The implementation according to SAI will be only about five, ten new gigawatt throughout the United States.

We believe that we could have five gigawatt per year, 1.5 gigawatt per year in the first five years of the implementations with the right incentives that will cover the difference between the current 17 cents per kilowatt hour and the utility rate cost of 6 cents. So in the form of a subsidy or tariff that would be phased out by 2020 we believe that we can have much higher penetration of solar.

And we do have the geographical potential in the southwest. We have at least 200,000 square miles of desert land that is not used in anything else and is suitable for constructing photovoltaic systems and concentrated solar power systems.

This area receives about 3,600 quadrillion BTU and as a nation we spend about 100 quadrillion BTU for all our end-use actually, including transportation, electricity and transportation. So if we capture just three percent of this then we can satisfy the total US annual energy consumption.

So work in progress that is going to be published in a high-impact journal so I don't have the liberty to disclose the details at this point. We show that based on just the southwest we can satisfy the needs of the whole country by mid-century.

And obviously we can add to this the one million roofs, the Governor of California's initiative. But that will be a much slower process.

So we do believe actually that the price getting down to the level that we can also, that it can also support storage. Storage technologies are evolving and 20 years from now we may have something a lot more effective. But even now we have a technology that has been proven for about 20 years. It's called compressed air energy storage and we have facilities in Iowa, we have facilities in Germany.

And we do believe that with the right scale the cost, the additional cost to electricity generation from photovoltaics from compressed air energy storage 24 hours is another two cents. So we do believe that we could by 2020 have a technology there that can give 24 hour electricity generation at about eight cents per kilowatt hour.

And also solar power with heat storage. We do have systems already operating with six hour storage. The Spaniards just integrated a system with 24 hour storage, thermal storage, so that we could use it to go over the diurnal cycles.

I guess you have to wait to the publication to see the details. But we do believe, and that's the bottom line, that solar can be an equal player, an equal player to nuclear and to clean coal in terms of potential. Not only a minority player but can be an equal player.

Now in conclusion. The life cycle framework is necessary to have a complete description in terms of sustainability, in terms of potentials of energy technologies.

By looking in all the cycles, in all the stages of the cycle of energy production technology we can describe items like resource availability and cost, potential risks and benefits. And I think that the time frame has to be not only this generation but also future generations. So depletion of fuel and so on.

With this I will be actually ready for questions from the Commissioners and the rest.

PRESIDING MEMBER PFANNENSTIEL: Thank you very much.

DR. FTHENAKIS: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Very interesting. Questions? Who wants to start?

ASSOCIATE MEMBER GEESMAN: In projecting costs out across generation, or benefit for that matter, what type of discount rate do you use and what's your rationale for the one that you select?

DR. FTHENAKIS: For the nuclear fuel cycle?

ASSOCIATE MEMBER GEESMAN: For any of the multi-generational, economic calculations you make.

DR. FTHENAKIS: We haven't done any economic calculations related to the nuclear fuel cycle other than the ones that were depicted in the economic input/output analysis based strictly on overnight costs. Nothing else than that.

The economic analysis in the solar cycle is not part of any, any comparative type of analysis. We assume there -- Actually James Mason, that I list here as my contributor, is the economics guy. I am a chemical engineer, that is his domain. But he assumes what we believe are kind of standard assumptions. A 15 percent, I think, credit, 30 year depreciation.

But I will have to -- If you need details in terms of our solar electric costs over the next several years I think we can disclose those only after the publication. We have agreed with the editor that we are not going to give any details out before the paper is published.

ASSOCIATE MEMBER GEESMAN: I'm not so much asking for that. I'm aware of the difficulty and the dispute among various economists in these long range projections as to the appropriate way to discount the future.

The Stern Commission had one particular perspective. In this country William Nordhaus attempted to rebut the Stern Report. The differences there, because both were using social discount rates, a substantial difference over a period of time. But based on a comparison with the cost of capital discount rates would both seem to be pretty low.

And I'm wondering if you have a particular perspective as to the appropriate way to look at costs and benefits out on a distant time horizon.

DR. FTHENAKIS: Mr. Geesman, we haven't actually used any cost analysis related to perhaps external costs and to what would be the carbon displacement cost.

This is not part of our analysis related to the prospects of solar. We just have the scenario of needed incentives for the price to become competitive, competitive with the utility generation, electricity. So we don't assign any carbon dioxide displacement credits at all.

ASSOCIATE MEMBER GEESMAN: Okay. Thank you.

DR. FTHENAKIS: Sure.

PRESIDING MEMBER PFANNENSTIEL: Yes, Commissioner Byron.

COMMISSIONER BYRON: Dr. Fthenakis, thank you for being here today. It sounds like you didn't get very much sleep last night.

I am very intrigued by some of the data that I have not seen before with regard to accidental risks, the fatalities in electricity production and also the maximum consequences for accidents. I was wondering, and maybe you covered this to some extent, but can you describe a little bit of the basis for how you come up with these projected fatalities for the various generating sources on your maximum consequences per accident figure.

DR. FTHENAKIS: Yes. the numbers that I showed related to the conventional energy technologies, they are not ours. They are the ones by the Paul Scherrer Institute, Roberto Dones and Stefan Hirschberg and their team. But I know how they actually, how they obtained those numbers. They are based on actual statistics. Those numbers are, according to their report that is available in the public domain, is based on actual statistics. With the exception of that number on PV. And they have a number on wind also that I don't, I don't show here, an equal number, 100, that is based on expert opinion.

Now our number, our number here is based on actual, statistical data from risk management program submissions to the US EPA related to the materials used in photovoltaics. So for example in different technologies we use different hazardous materials. In the photovoltaic cycle crystalline silicone, we'll be using hydrochloric acid. Hydrochloric acid in the manufacturing of the modules. Upstream in the manufacturing of the metallurgical silicone will be silicone trichloride. In the silicone we use xylene, we're using hydrogen.

So as part of the life cycle analysis we will be looking into consequence, accidental data. In this cases are consequences, fatalities, related to the production of hydrogen and related to the production of silicon trichloride, to the production of xylene, production of hydrochloric acid. If we normalize these, the usage of these gases in the photovoltaic industry and electricity output. We normalize those.

So that's how we derive this number here for the United States, for the United States. If we're looking to Asia we have different numbers. For example, we had an accident that caused one fatality in Taiwan in November of '05 in an actual production facility. We had another one three months ago in India. But this is all United States and this is OECD. So it's not exactly apples with apples. This is OECD, this is United States. I'm wondering if this answered your question.

COMMISSIONER BYRON: Well I am most interested in the nuclear one.

DR. FTHENAKIS: Oh, in the nuclear.

COMMISSIONER BYRON: Yes.

DR. FTHENAKIS: In the nuclear, these are numbers from the Paul Scherrer Institute. They corresponded to their assessment of what was the actual, the actual number of fatalities, including obviously latent fatalities from Chernobyl. It is not my number, it is not my number.

COMMISSIONER BYRON: What about the nuclear except Chernobyl?

DR. FTHENAKIS: The low one?

COMMISSIONER BYRON: Yes.

DR. FTHENAKIS: This corresponds to a 1957 accident in the ex-Soviet Union. I think Chelyabinsk is the location. So it corresponds to an actual, an actual accident.

DR. COCHRAN: It must be the key steam accident.

DR. FTHENAKIS: I'm sorry?

MR. WILLIAMS (FROM THE AUDIENCE): That was the nitrate that blew up in the reprocessing plant.

DR. COCHRAN: A waste tank explosion.

PRESIDING MEMBER PFANNENSTIEL: Excuse me, if people aren't speaking into the microphone it is not getting picked up by the record at all.

COMMISSIONER BYRON: Okay. Well I think I'm getting a better sense of the basis for the numbers as they are. It is not some credible accident that is being projected, this is based upon actual data going back to some events.

DR. FTHENAKIS: Exactly.

COMMISSIONER BYRON: Okay.

DR. FTHENAKIS: With the exception, with the exception of their numbers on renewables. Photovoltaics and wind. I'm talking about Paul Scherrer Institute's numbers. They are based on expert opinion. Because the industry is so small that they thought there were not enough really data in databases to quantify the potential, the potential for an accident in those technologies. But those are numbers, actually exact numbers as they were presented from actual incidents.

COMMISSIONER BYRON: Thank you.

DR. FTHENAKIS: My pleasure.

PRESIDING MEMBER PFANNENSTIEL: Anything else? Thank you sir, very much for adding to our record.

DR. FTHENAKIS: My pleasure.

DR. WEISENMILLER: Our next speaker is Mary Quillian, who is the Director of Business and Environmental Policy at the Nuclear Energy Institute, which is the strategic policy group for the nuclear energy industry. She is primarily focusing on establishing policies that encourage construction of new nuclear power plants and highlights the value of nuclear energy as a source of clean, affordable energy.

So was at Cinergy before and she has a bachelor's of science in mechanical engineering from Cornell and an MBA from the Sloan School of Management at MIT.

MS. QUILLIAN: Thank you, all of you, distinguished Commissioners, for inviting me to speak here today. I am Mary Quillian, I work at the Nuclear Energy Institute, which is the policy organization for the commercial nuclear industry. We are based in Washington. Our members include all utilities that have operating licenses and operate nuclear power plants in the United States, including many of the companies that support those operators, nuclear vendors, reactor designers, engineering firms, fuel fabrication industries, et cetera, et cetera. Next slide, please.

Today I am going to talk briefly about several topics. The economics, safety and environmental benefits of nuclear energy. I would like to go over new plants.

You are going to hear some specific details from the point of view of a company that is actually pursuing a new nuclear power plant from Joe Turnage later but I am going to talk more generally about the industry looking at these things.

And I will try to hit upon standardization, which I know is something you all are interested in, used fuel and how that plays into new plants, and financing issues.

I will briefly review the stimulus in the Energy Policy Act of 2005 for new nuclear power plant construction. And we'll talk about what individual states are doing these days to support new nuclear construction.

And lastly I'll just sort of think about electricity demand growth in California and how we're going to tackle that. Or how you guys are going to tackle that. Next slide, please.

Capacity factors. As you can see the nuclear industry over the last 20 years has done a phenomenal job of increasing our efficiency and in the last five or six years have turned in a pretty steady performance of capacity factors at about 90 percent. That's far above the capacity factors of other industries.

And I might add that we keep capacity factor numbers that include outages so the refueling outages are a part of those numbers.

That means that, you know, in some years there are lots of plants that have capacity factors well above 90 percent because there are other plants that are refueling. Next slide.

Increased capacity factors have also led us to be able to increase generation and we have had record or near-record generation numbers for the last several years from the US nuclear fleet. Next slide.

That has also led to very steady or slightly declining production costs among the fleet of nuclear power plants in the United States. Next slide.

Part of the reason nuclear power production costs are stable and low is because of the parts of the production costs. If we look at this slide we notice that for fossil-fired generation like coal and gas an overwhelming large percentage of production costs is the cost of the fuel that goes into producing electricity from those different technologies. So as those fuel prices go up and down that affects the price of the electricity generated at those plants.

Whereas with nuclear fuel only comprises about a quarter of the production costs and the rest, the O&M, is very predictable. It's people and obviously other parts of operation and maintenance. And of that fuel cost only about half of that is the uranium. We saw earlier a mention that uranium's spot market prices are at a record high now.

And whereas I do think at some point that will show up in our production costs because there is a delay, I'd also like to note that most of our utilities do not purchase their uranium from the spot market. A very small percentage of the uranium they purchase is actually from the spot market and most of it is done through negotiated contracts. And if the spot market is going up today you might wait for a week and it will go down $10 and that kind of a thing. And then again you're also not buying from that market but you negotiate directly with uranium suppliers for that.

I'll also point out one other thing here and that is that our production costs include, includes the fees that go to the Nuclear Waste Fund. It's about ten percent of the fuel cost. Next slide please.

Let me turn to safety. We just heard a

lot of information about safety. I just am going to give the update to a slide that was shown earlier. These are 2006 statistics, which do indeed show that the nuclear power plant ISAR number has gone down since 2004. We are well below the ISAR number for the electric utility industry as a whole and below manufacturing. So fundamentally nuclear power plants are pretty safe places to work. Next slide please.

All right, environmental benefits. Nuclear power provides about 20 percent of electricity in the United States. It is non-greenhouse gas emitting in the generation aspect of nuclear power.

The operation of the nuclear power plants in 2006 prevented 681 million metric tons of greenhouse gas emissions into the atmosphere. That number is calculated by a regional average of fossil mix that would have been employed to produce power regionally if nuclear power plants did not run. That number is more than two times the amount of greenhouse gases prevented by all the other non-emitting sources in the United States combined.

I would also just like to point out that in terms of capacity in the United States there is about 100 megawatts -- I'm sorry, 100,000 megawatts of nuclear capacity in the United States. There is roughly about the same amount of hydro capacity in the United States. Next slide please.

We also just heard a report on life cycle emissions. And it is interesting that all the various studies that Professor Fthenakis cited are none of the ones I cited in my comments that we turned in to the Commission, I actually have five different studies, so now you have a plethora of information on life cycle emission data.

And all of them come to the same conclusion. And that is, the life cycle emissions from nuclear power are comparable to the life cycle emissions of renewable energy. So this notion that the fuel fabrication and externalities associate with producing nuclear energy contribute tremendously to greenhouse gas emissions is just fundamentally wrong. Because per kilowatt hour it's comparable with other renewable sources. Next slide.

Okay, let's turn now to new plants. I'm going to here talk a little bit about standardization. I know that's something you're interested in. I'll tell you that's definitely something the industry is interested in. I think as an industry since we do have what we sometimes like to call 104 unique nuclear power plants operating today, standardization is something that industry has been focused on and definitely supports.

How does standardization reduce the costs of nuclear energy? Well, it is very costly to design a nuclear reactor, as you might imagine. So if you can design it once and build that same reactor several times you will spread those design costs over several plants. That will reduce the cost.

Construction practices. The more often you build the same plant the better you are going to get at it. And those efficiencies that you gain, frankly just from experience, will reduce both time and resources that will have to be employed to construct that plant. There are some real examples of this in Japan. I know of one where after building a couple of the same plant, the last one they built they were able to build in just 42 months.

Parts and components. If you have got several plants that are using the same parts it makes your procurement and your sort of spare parts inventory operations more efficient.

Overall there is a tremendous efficiency gain from the regulatory interface aspect of this. The NRC has to review in detail that design once. And then in the future when companies come with an application for that design it allows the NRC to focus on site-specific issues because they have already approved that design.

The regulatory interface efficiencies continue when it comes to inspection. You will have plant inspectors that become very familiar with a particular design that can go from plant to plant that are all of that same design.

Then you have the ability to incorporate design improvements across the board. A design improvement might be an upgrade or an improvement to an operations or maintenance procedure, which has to be reviewed by the NRC. So if they review that once then that improvement can be applied to all the different plants of the same design family.

Finally there are clearly going to be

operation and maintenance gains. The industry expects the operating costs of the new plants once they get going to actually be less than the operating costs of the plants today. And seeing as how we have one of the lowest operating costs today that's pretty remarkable. That will be --

Those gains will come from procedures. Every plant has to develop its own operating and maintenance procedures today because they are so unique. If you have same design plants out there you design those procedures once and you can apply them to the suite of the same plant.

Good practices and training become easier. Easier to share skilled workers.

You have more efficient outages for the same reason you have more efficient construction. The more you do it the more you learn, the more you can apply to the next outage.

And then finally all of those things should lead, frankly, to improved equipment reliability. And that will also bring costs down. Next slide please.

Fuel. And where does this fit in to the picture of new, nuclear power plants? Up until recently the United States was focused on a once-through fuel cycle, which would put the used fuel that contained 90 percent of the energy it had when it started, in a long-term repository. Next slide.

I think that everyone is now looking for a new strategy and we know that the Department of Energy, for example, is working on a new strategy to close the fuel cycle. Closing the fuel cycle fundamentally will be a good idea. In the long run it should make good business sense. Furthermore, it's the right thing to do from an environmental stewardship point of view. So in the long run industry is very supportive of this. However, this is going to take a lot of new technology.

We are going to have to develop new advanced technologies to separate out the components of the used fuel in a more proliferation-resistant manner. We are going to have to develop facilities that will take some of those components and process them back into fuel that can be used in current light water reactors. We have to develop fast reactors that can the use some of those other constituents from the used fuel. And finally, there will continue to be byproducts. Even a closed fuel cycle produces byproducts that will require long-term disposal in a repository. So pursuing Yucca Mountain continues to make sense, even in this fuel cycle regime. Next slide.

Industry is interested in the potential for closing the fuel cycle for a number of reasons. One of them is, as we start to look at potential facilities for some of these reprocessing technologies they become very good candidates for interim storage of used fuel because the used fuel would have to go there eventually. We think that that makes sense and we encourage the Department of Energy and we did encourage Congress to continue to look at that option.

One of the things we're recommending is that this pursuit of a closed fuel cycle be done in a phased approach. And what I mean by that is since there continues to be research that needs to be done to deploy demonstration models of these technologies and eventually get to commercialization.

We think it makes sense to have a phased approach so that you can remain flexible as you're doing those research and deployments of various technologies so you can really -- you can get the right answer. You can give the scientists and engineers really the time to flesh out those different technologies and make sure we're doing it right. Because in the end that's where we need to get to. Next slide.

Clearly the used fuel management issue is not a, is not a show stopper for the nuclear industry. There are 17 companies or consortia that have announced they are pursuing the submittal of a license application to the Nuclear Regulatory Commission over the next several years. That could be more than 30 units. Next slide.

Let me talk a little bit about the licensing process and the timeline for that licensing process and construction. As mentioned earlier, there is a new licensing process that was put in place in 1992. This new licensing process has three parts. The actual design. Hopefully that standardized design is certified.

You have an option for an early site permit where a company or a utility that would very much like to have a site reviewed for all the site-specific issues like seismic and environmental impact and things like that, they can go to through an early site permit. They don't need to have chosen a design for the reactor at that point.

And then finally you have the combined construction and operating license, or COL as we call it in the industry. And that is where you pair a site with a design. Clearly you have to have the design certification well underway when you put a COL in, but you can do the design certification and the early site permitting concurrently with the COL.

So companies today, the 17 companies, have been preparing applications. To put together an application takes about 18 to 24 months. After you get your application done you submit it to the NRC and the NRC is going to take about three years to review those applications, particularly the applications of the first in a design. So in other words, later applications using the same design should see reduced review times at the NRC because the NRC has already approved a COL with that design.

And frankly, these applications are about 70 percent design-specific, 30 percent site-specific. So you can see where there is regulatory efficiency if they have already reviewed that design and given a license and they have okayed that design once. Then clearly they focus on the other 30 percent of future applications which are site-specific.

When a company puts an application into the NRC they can, they won't necessarily always do this but they can begin some very limited site preparation. And that would include site clearing and grading work and things like building roads and parking lots. So nothing plant specific but site prep that would get you ready for construction.

Construction of the plant itself cannot begin until after receiving a COL from the Nuclear Regulatory Commission. And once that happens we estimate that the first plants will take somewhere between four to six years to be constructed. Again, because of standardization we anticipate that construction time for future plants of the same design to be reduced significantly.

I might add that another thing that is happening during the review of the COL is the procurement of long-lead items and putting down deposits for places in the queue for things like large forgings. And there are companies out there that have, that have plopped down some money for places in the queue and for long lead time items.

The preparation of the -- The preparation of the license application itself, the fees for filing an application, as well as the cost of seeing that application through the review process, because it's a very interactive back and forth process during the NRC review, probably costs somewhere between 45 and 90 million dollars. And so 17 companies are willing to put that kind of money down to reserve the option to build a nuclear plant in the future.

Once a plant gets their COL they begin construction. And during the construction process the NRC will be reviewing something called ITAACs. And ITAACs are basically construction acceptance criteria or standards which are specifically written in the license. And the NRC will be checking those things off making sure that those standards were met during construction and in the sort of testing phase of start-up.

And once all of those ITAAC are signed off by the NRC, which says, which basically means that the plant was built to the standards and qualifications in the design, then the plant can immediately proceed to operation and there is no additional step of going back for an additional license as there used to be. Next slide please.

Financing. Here is the big one. All right, let's first talk about the Energy Policy Act. And the three main incentives in the Energy Policy Act for new nuclear power plant construction boiled down to the production tax credit, the standby support and the loan guarantee program.

The production tax credit is an 18 megawatt -- $18 per megawatt hour tax credit for the first 6,000 megawatts of electricity or the first 6,000 megawatts of capacity of new nuclear capacity.

Guidance issued by the Department of the Treasury indicates that those 6,000 megawatts will be distributed over all plants that meet three time criteria. They have submitted their COL application by the end of 2008, they begin construction by the beginning of 2014, and they start commercial operations by the beginning of 2021.

We estimate that the production tax credit is probably worth somewhere between $5 and $7 a megawatt hour.

The production tax credit is a tremendous incentive to get to operating the new nuclear power plants. To get to the operation stage. However, the PTC does very little in helping companies finance the construction, and frankly that is where the heavy lift is in getting these plants built. Next slide.

Then there is standby support, which was intended to be an insurance. A federal insurance to cover specifically delays resulting from litigation and licensing.

That coverage for the first two plants is $500 million and the coverage for the next four plants is $250 million. It would only go towards 50 percent of the costs and it would only kick in six months after a delay began.

I should say this has limited value, frankly, from the point of view of executives in the industry for a couple of reasons. First of all, it only covers debt coverage. So basically the interest is all that this insurance would cover and there are significant other costs that you would be incurring during any sort of delay such as paying your workers.

And the other reason why this is limited is that those next four plants, since the coverage doesn't kick in until six months after a delay begins, a company basically has to eat six months of delay costs. That's a lot of delay and frankly we're really hoping not to have to wait that long.

So what we found is that this particular stimulus, whereas it was well-intentioned and the idea was good, the actual value that the executives making decisions on whether to build nuclear power plants, this doesn't play much into their decisions. But the next one is very important and that's the loan guarantee program.

The loan guarantee program, it comes out of Title 17 of the Energy Policy Act of 2005. And let me stress that it is not nuclear-specific. Title 17 in my opinion was very visionary. The idea was to encourage the commercialization of new technologies not yet deployed in the United States that specifically reduce, avoid or sequester greenhouse gas emissions or other emissions. That means renewables, clean coal, clean transmission, cleaner refineries, nuclear power plants and a bunch of other stuff. So there are a lot of different technologies that would benefit from this federal loan guarantee program.

The federal loan guarantee program authorizes the Department of Energy to provide a guarantee for up to 80 percent of the cost of the plant or the project. Earlier the loan guarantee program was mentioned.

Right now the Department of Energy is in the middle of a comment period on proposed rules for this program. Their proposed rules -- In their proposed rules they suggested that they would only cover 90 percent of the debt. Eighty percent of the project cost and 90 percent of the debt are two very different things. So that's a little bit where this confusion comes in. So the comment period, we're in the middle of the comment period. The comment period ends July 2 and we expect that the Department of Energy will finalize rules for the loan guarantee program this fall.

Congress when they appropriated some money to get that program up and running, administrative costs if you will, this last winter, prohibited them from issuing any loan guarantees until they finalize the regulations.

So we won't, we won't see any loan guarantees coming out until they finalize the regulations, hopefully towards the end of this year.

Part of the --

ASSOCIATE MEMBER GEESMAN: Can I interrupt? Can I interrupt?

MS. QUILLIAN: Of course.

ASSOCIATE MEMBER GEESMAN: Can there be loan guarantees before there is a subsequent Congressional appropriation?

MS. QUILLIAN: It depends on which lawyer you ask. There are -- That is still, frankly, being worked out. There are loan guarantee programs that exist. For example, OPEC and the Ex-Im Bank program. The Ex-Im Bank program has the authority to make loan guarantees up to, what is it, $100 billion I think.

DR. TURNAGE: It's capped at Ex-Im at $100 billion in any one year.

MS. QUILLIAN: Yes. So they have the authority to issue loan guarantees up to $100 billion for the deployment of US technologies in foreign countries. And as some people point out, you could build a nuclear power plant in Mexico easier than you can build a nuclear power plant in

New Mexico given US loan guarantee programs that already are established.

DR. TURNAGE: Mary, if I could amplify that just a little bit. It's required that there be a subsidy cost, a cost to the loan guarantee program, by statute. It could have been by Congressional appropriation or by the applicant paying a fee or a combination of those. I think the reality is that the applicants are going to pay the fee. So there's no hit to the federal budget.

But there right now is a requirement under the Federal Credit Reform Act that there be an annual authorization, as is done with Ex-Im Bank. So it's an issue about the size of that cap. And the real issue is an annual authorization for that cap as opposed to an explicit appropriation.

MS. QUILLIAN: Thanks Joe. He's absolutely right. The cost of the program we expect will be borne by the projects that are paying the fee for the loan guarantee.

ASSOCIATE MEMBER GEESMAN: Yes. My question is a lot more practical than that. If I'm Citibank or some other lender and I am about to loan one of your projects 90 percent -- rather I am about to loan your project money and I am expecting that 90 percent of my debt will be guaranteed. Will my counsel give me a legal opinion that I have a federal loan guarantee without a separate appropriation?

DR. TURNAGE: Two things would have to happen. I think that an annual authorization of the magnitude of the total cap. So I would have to have a line of sight that I would qualify for that. And we would intend to get a conditional, terms and conditions on a federal loan guarantee in hand before I talked to the banks.

ASSOCIATE MEMBER GEESMAN: Okay, thank you.

MS. QUILLIAN: Thanks, Joe. Since he's doing it he's got a better answer for you on that one.

Generally loan guarantees will reduce costs, and specifically it will reduce the cost of electricity from these projects. Not just nuclear but wind, clean coal, all the other ones too, for several reasons. It allows project developers to increase their leverage, which means more debt versus equity. And debt is cheaper than equity.

And it would reduce the financing costs because a guaranteed loan is going to have lower interest than a non-guaranteed loan.

And finally it allows -- Basically what it does is it makes that debt non-recourse to the project sponsor. And what that does is very important because it reduces the impact on a credit rating of the parent that may be undertaking that project. And that is very important. Next slide.

To get a new nuclear power plant built, it's a big undertaking. We don't cite specific costs right now because we don't know exactly what it's going to cost. Frankly the detailed engineering work is ongoing as these various companies, various 17 companies, prepare their applications. And given that detailed work we'd like to wait until those costs are done.

We also are keenly aware of the fact that prices for steel and concrete are going up these days. But we do think that a nuclear power plant is probably going to come in somewhere between five and six billion dollars. That's a big, big price.

In order to get a nuclear power plant

built, frankly, companies, regulators, the federal government, are going to have to figure out a way for some equitable risk-sharing in this. And because -- And I think that there are several states that are starting to recognize that and several states have begun putting in policies that allow some risk to be borne by the consumers and some risk to be borne by the shareholders. And the federal loan guarantee would say, some risk borne by the federal government in getting new nuclear power plants built.

Part of the reason why these states are in fact looking at policies for new nuclear are because they see the value in a diversified portfolio. And right now the only thing an electric utility executive feels remotely safe about building is renewable and gas. And we can't get enough of that built in the near-term to meet some of the needs that are projected in 2010 and 2012. So the diversification of fuel sources and the volatile price of natural gas, frankly, is another reason why they're seeking that.

So what are they doing? Next slide. there are several states that have put in place policies either through legislation and/regulation that allow a couple of things. QUIP. And what is QUIP? Well really what they're allowing is they are allowing the carrying cost of the construction project to be passed on through rates during the construction. Capital costs will not go into rates until the end of the project when the nuclear power plant comes on-line and becomes useful. But that, allowing the carrying costs to get passed through, reduces the revenue hit to the utility during construction and that is very important.

The other thing about those particular policies, which are, I believe, equally as important, is an ongoing periodic prudency review. And I don't think there is any company out there in a regulated area that would build a nuclear power plant given a five or six year construction period and just hope that the regulators would approve it at the end of the five or six years and put it into rate base.

So they need some sort of assurance up front that the regulators think it's a good idea to pursue the nuclear plant and then on a regular basis during construction or reviewing those costs and finding them prudent along as you go. I just think that makes so much sense because it's a shared decision process.

ASSOCIATE MEMBER GEESMAN: Can I interrupt again?

MS. QUILLIAN: Of course.

ASSOCIATE MEMBER GEESMAN: What if they decide in year two or year three that those costs weren't prudently incurred. What happens then?

MS. QUILLIAN: Well, at that point I would say that the utility would think twice about continuing. There is in most of those policies, any costs that have been found prudent or have been pre-approved, even if the plant is not finished are put in rates and recovered. So I -- Well there would be a new discussion at that point. I can't tell you exactly what the utility would do, it would depend on the time. But that's information, that's good information for them in the middle of construction rather than at the end of construction.

ASSOCIATE MEMBER GEESMAN: It's dreadful information at the time that you're trying to get financing.

MS. QUILLIAN: Oh no, you've got financing at that point. I mean --

ASSOCIATE MEMBER GEESMAN: But ongoing prudency reviews are one thing. As long as you assume the answer will be yes each time you come up for review. If you can actually contemplate that the answer may be no, isn't that an awful lot of risk for a utility to take?

MS. QUILLIAN: Well if the answer is no that gives the utility the opportunity to stop right there. The costs that they have incurred are going to be recovered and therefore they shouldn't be racking up any more debt.

ASSOCIATE MEMBER GEESMAN: So if I'm the CEO does my bonus get approved that year or not? (Laughter).

PRESIDING MEMBER PFANNENSTIEL: Probably.

MS. QUILLIAN: It depends on what the, it depends on what the reward system is for that particular CEO and that particular company.

ASSOCIATE MEMBER GEESMAN: The only former utility executive on the Commission says probably, so --

PRESIDING MEMBER PFANNENSTIEL: Whoops.

MS. QUILLIAN: So there you go.

But one of the other things I'll point

out here with states moving forward on policies to support new nuclear is that just because it's been a central theme discussions over the last few days is the waste issue. These states clearly are comfortable with having near-term waste management in place and movement towards final disposal or a final reprocessing option.

And they are willing to deal with the near-term waste management issues, which frankly we've proved we can do, either through short-term on-site storage and then interim storage. They're willing to accept that in order to get new nuclear power plants built for various reasons that mostly include fuel diversification and electricity rates in the future. So next slide. We're almost done.

Let's talk a little bit about electricity growth and greenhouse gas emissions and all that kind of good stuff. Forgive me, I'm using EIA numbers here. Frankly, because I couldn't find 2030 predictions from the CEC and California energy demand. I'm sure you have them, I'm just not adept at your website so please forgive me.

So the Department of Energy's Energy Information Administration in their Annual Energy

Outlook in 2007 showed that California's electricity growth is actually predicted to outpace slightly the national electricity growth overall. And we do know that in recent years your electricity demand growth has been what, between four and six percent a year. And that's pretty high, you know. It's what, about two percent a year nationally.

And we know there are certain parts of the country, and California is one of them, the Southeast is another, Florida particularly, where you've got population growth and you've got demand growth that's ranging around five or six percent. And you have to deal with that. How is California going to deal with that, especially in light of the greenhouse gas emission limitations that frankly California has been a leader in putting in place. Their prediction --

And they take into consideration, as far as I -- Well actually no, I take that back. In their introduction they talked about California's greenhouse gas emission reduction mandate. But because there isn't any clear line of sight in how that is going to yet be put in place they were unable to factor that in their calculations. So the 27 gigawatts of capacity additions they are predicting for California obviously does not consider greenhouse gas emission reduction mandates here.

They are predicting 292 gigawatts of electricity capacity has to be added to the United States. That's a lot. And let me tell you, they are not predicting very much of that is going to be nuclear.

If what happens is what they predict, nuclear energy will go from about 20 percent of the fuel mix to about 16. That's a US number. What if we wanted to keep nuclear at 20 percent? What would we need to do between now and 2030? Well we need to build about 50 gigawatts. We think that's doable. We did it in the 1970s where we built 51 gigawatts. We did it in the 1980s where we built almost 55 gigawatts. So it's clearly doable. But it is going to mean a lot of other things like policies have to fall into place to support that.

So I just kind of throw that up there because there are some interesting conundrums to think about. And I think one of the basic ones is marrying environmental goals to electricity demand

and figuring out how that is going to be.

The one thing I will say, and this will probably surprise you coming from somebody at NEI. But we're going to end up building a lot of stuff. Nuclear is not the answer, and we have never claimed it to be. But we do think that nuclear energy is an important part and an important tool in building a generation system in the future that will meet greenhouse gas emission reduction criteria.

Okay, lastly I'd just like to leave you with two little quotes here. The California politicians that represent you all in Washington are starting to change their tune on nuclear. Senator Boxer, who as you well know is Chair of the Environment and Public Works Committee, has recently said that she thinks that we're going to be seeing new nuclear power plants in the United States.

And then, next slide, Nancy Pelosi, our House Speaker, has admitted that we have to keep an open mind because nuclear has to be on the table, it has to be considered. And so I think that's a significant shift.

And I will say I appreciate the

opportunity to come speak to you today and answer your questions and I would be happy to answer questions in the future if they should arise. Or questions right now.

PRESIDING MEMBER PFANNENSTIEL: Thank you very much for being here. I know you dealt with some of the tough questions as we went. Are there further questions?

ASSOCIATE MEMBER GEESMAN: I have a question.

MS. QUILLIAN: Another one?

ASSOCIATE MEMBER GEESMAN: This doesn't relate to financing. On the question of trying to boost credibility among the public and with regulators in particular. Have you any thoughts as to how better use can be made of the INPO process and the INPO organization? And specifically, what information needs to be kept private versus what can be publicly disseminated.

MS. QUILLIAN: I personally don't. But I'll tell you, given your questions this morning, Commissioner Geesman, I was talking to a colleague over lunch about this particular issue. And I personally think that we need to go back and we need to look at that. Because inside the industry

INPO is considered a program that really holds each company and each operator's feet to the fire.

We all know that we are as strong as the weakest link. So any major problem at any plant, frankly globally, but let's say nationally because we have a much better handle on that, affects all of us. So the self-policing mechanisms and real focus on instilling best practices and safety culture and those types of things, INPO does a real good job at that.

And obviously things slip through the cracks. Obviously problems happen. I will tell you, there are always lessons learned from those problems. Every single nuclear power plant, every single day, spends a few minutes at their morning meeting talking about some operational issue that either they've had or somebody else has recently experienced and thinking about how that could affect that plant and what they need to do to prevent that from happening at that plant. And that's pretty significant that they think about it every day.

So I don't have a good answer for you. But I will tell you that I am going to take this issue back and hopefully get some discussion among industry and INPO because it's a good question and we should be mulling that over.

ASSOCIATE MEMBER GEESMAN: I think that in other industries you will see that self-regulatory organizations serve a real valuable role. And in the particular paradigm that your industry has been in for several decades now I do think you're judged by your weakest link.

And I understand herd logic at times allows the weakest of the wildebeests to dictate policy for everyone. I think your industry would be better served if you had more of an only the strong will survive approach. Thanks.

COMMISSIONER BYRON: What has become clear to me as well is that it's organizations like INPO and the kind of inspections that the nuclear industry sustains all the time, don't just address safety. Clearly there's been tremendous success in recent years, as you indicated in your data, with performance and also O&M. I have seen figures over the last 20 years that have shown tremendous gains in reducing O&M costs.

So I would attribute those inspections and that self-policing has had a lot to do with that as well. I should probably ask that in the form of a question. Would you agree with that? (Laughter).

MS. QUILLIAN: Yes.

COMMISSIONER BYRON: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Other questions? I want to say that I really appreciate your being here. I think you provided both valuable information and a very useful perspective for us, thank you.

MS. QUILLIAN: Thank you.

DR. WEISENMILLER: Commissioners, our next speaker will be Joe Turnage Joe is a Senior Vice President of Constellation Generation Group and he is currently focused on successfully deploying a fleet of at least four US advanced nuclear power plants in North America.

Prior to Constellation he was Senior Vice President and Chief Technology Officer for Pacific Gas and Electric Company's unregulated subsidiary, PG&E National Energy Group. And prior to that he was President of Tenera Energy, a consulting firm for the power industry.

And Dr. Turnage holds a PhD in nuclear engineering from MIT.

DR. TURNAGE: Okay, now if I can figure

out how to scroll this. Thanks a lot, it is a privilege to be here. I really appreciate the opportunity. I appreciate the opportunity to come back to California any time. I moved from Huntington Beach to the East Coast in 1997 and my wife has never forgiven me for that.

This is great. Jim Harding teed me up beautifully earlier today so I'm going to be appreciative of him for that because I am going to talk to you today from a point of view of, in fact, a merchant generating company that is looking to deploy a fleet of advanced nuclear reactors.

When we will make a decision to build a plant the economic risk of that will be borne by our stockholders. It will not be borne by any rate payer. So what my presentation is kind of about is how does a conservative company, risk-averse, do such a thing.

Constellation by the way, you probably know, is the nation's largest wholesale seller of electricity. And it's the largest retail seller of electricity. Larger maybe than the next three competitors combined. We sell electricity in every place where the regulations allow retail and wholesale sales. We sell to over 70 of the Fortune 100 companies, for example. So our models and our fundamental business orientation is that of a competitive, merchant energy supplier.

You folks have seen an awful lot of this stuff and I'm going to page through it quickly. What you have got for the record is a bit of a drink from a fire hose so I won't go through all that again. But a couple of comments about the forces that we saw beginning to drive and shape what is now called the renaissance of nuclear.

And it really begins with the fundamentals of supply and demand. We haven't built adequate baseload generation in this country and it is getting acute in many of the regions of the country.

There is a study that EIA tosses around that says that just to maintain nuclear's share of 20 percent of the nation's electric supply by 2035 -- that's an interesting date because many of the current fleet retire between 2030 and 2035. But to maintain that 20 percent requires about 81,000 megawatts of new nuclear power plants. That's a heavy lift.

But in many areas that we are examining

deploying plants the fundamentals of supply and demand are calling for the need for new baseload generation. You've heard Mary talk about the one-step licensing process, a new regulatory process.

I need not go into that other than we are engaged right now with the Nuclear Regulatory Commission for our reference combined operating license. We've submitted our Q8 program, it's been accepted and approved. We are working within the next several weeks to submit our environmental report, which is a very significant part of the combined operating license.

At the same time AREVA, our nuclear system supplier, is proceeding with the NRC to secure design certification for what we're calling the US EPR.

Public acceptance has improved. You've seen the NEI numbers that they're enthusiastic about nuclear. MIT in 2002 did an analysis of public acceptance of nuclear and did another one, updated it five years later this year, and it's closer to 50/50. So when I tell people that there is more enthusiasm for nuclear these days I get a response from -- I remember John Sununu about a year ago and he said, yeah, but it's only one micron deep. I think that continues to be an issue for us. But much less so in the local communities typically around operating nuclear plants.

In exploring the site for our reference plant, which is in Calvert County, Maryland, we went and talked to the folks there. And this is kind of typical. A guy stands up in the room and he says, when I moved to Calvert County this was the poorest county in Maryland. Now property values were low. Calvert Cliffs was built. And when my daughter needed an elementary school to go to this plant's property taxes helped build it. And when she needed a high school it helped there too. Now property values are very high and we're a relatively affluent county in the state. Please come build Calvert Cliffs Unit 3.

So where we are interested in deploying plants are areas where the fundamentals of supply and demand work, where the fundamentals of land and water and transmission and access to load work, and where there is strong public support.

Greenhouse gases. You have heard an awful lot about that and I've got slides in here totally redundant to the slides you saw from

Brookhaven National Laboratory and others. Interesting to me was the driver of greenhouse gases I believe is why the Energy Policy Act of '05 passed with such widespread bipartisan support.

I was in OECD in Paris last summer and it was just interesting. There is a nuclear renaissance in the European Union as well as here. There it is driven by the economic implications of the carbon cap and trade program. Here I believe the nuclear renaissance is driven by the Nuclear Policy Act. But that in turn was driven by concerns about greenhouse gas to secure the boats for the EPAct of '05. So behind the renaissance of new nuclear is true concerns about global warming and the fact that this fundamentally a non-CO2 emitter.

Technology's advanced with all the nuclear designs. They're all about a factor of ten safer if you look at safety as core melt frequency. I will say a little bit but not very much about the particular reactor choice and technology we've chosen and why. And overall it's all packaged in with the Energy Policy Act.

I can't avoid just mentioning this one

issue on the CO2. Nuclear, a clean, green, generating machine. I just love that. That's not my quote, it's from the Governor of Mississippi, Haley Barbour. And I have to admit I enjoyed that.

This is Socolow's wedge. You've seen that I know. Take away from this, truly dealing with CO2 globally is a very heavy lift. And these are some equivalences that Socolow pointed. That adding twice today's nuclear output to displace coal is like driving two billion cars on ethanol, using one-sixth of the world's crop land.

And his point is, these are seven wedges here. And we need them all just to maintain current carbon emissions over the next 50 years. And I guess the thing I would suggest to you is that I know that for some the role of nuclear in a low-carbon energy future is, if you'll pardon this, an inconvenient truth, but it is the truth.

On the Energy Policy Act. You've heard about standby supports and production tax credits. I'll amplify a little bit about the loan guarantees and the status and what our heartburn is with the status. And you'll see some analysis later that I'm going to present of the economic implications of all of those incentives, production tax credits and the loan guarantees from a merchant perspective.

Right now the rules suggest, as Mary has told you, that there is going to be a requirement for about ten percent of the debt to be not backed by a federal loan guarantee. So 90 percent guaranteed, 10 percent not guaranteed. Candidly, we could live with that.

But the problem is the package. Because the same proposed rules contain the elimination of pari passu treatment of the second-tier debt falling with default. I've got lenders that would be absolutely prepared to loan me 100 percent of the debt but when they see that they say, I don't think so. Even worse, most lenders would like to strip away the federal insured portion of the debt, take that to secondary markets and manage their risk. That's not allowed.

So the combination of a requirement for a second tranche debt and the lack of pari passu treatment and the lack of the ability to strip create a kind of unworkable package for us. There is no natural market for that. We've got markets for secured debt, we've got markets for risky debt. But this weird hybrid contains no natural market and I think that's going to be a real problem for us.

We're certainly making comments to that effect in terms of our responses to the draft rulemaking. We're working hard to influence, not the Department of Energy. I could not say this six months ago. But today they get it. OMB and Treasury does not. And our struggle to get the rules right is about the interagencies and getting them to the place that DOE now is at.

Alternatively we are also proposing to the Congress, legislative fixes. I know that DOE is hard over on no pari passu because of their interpretation of the statute in the Energy Policy Act. We have a different interpretation. We'll explain legally our logic behind that. But quite frankly, it might be easier to legislatively fix that than to persuade DOE to change its mind.

And I know that OMB and Treasury are interested in this unguaranteed tranche of debt, mostly because they don't trust DOE to be competent to do a robust credit analysis of the default probability of these projects.

Now when we push back and say, these are very large companies for nuclear projects with $1 billion or so of equity at risk. You're not going to get some shabby, failure-prone proposal from these guys. And the response back is, we're not so much worried about you guys. I'm worried about the ma and pa shop ethanol producers that would qualify as well.

I think there are answers to this but I think that those are the driving forces. And right now we're early on. Comments will be received on Monday. But you're going to hear more and more from our company, the issue of federal loan guarantees is critical. We're a green light right now, full speed ahead. But should we not get those rules right it'll turn to yellow to red.

ASSOCIATE MEMBER GEESMAN: Is there also a limit on the number of guarantees that a single company can --

DR. TURNAGE: Not by statute. And there's no overall cap by statute.

ASSOCIATE MEMBER GEESMAN: What about in terms of DOE?

DR. TURNAGE: Politically I think there will be a requirement for a cap and it will be capped as part of an annual authorization process that we discussed earlier. I think it needs to be a fairly large cap. These are $5-ish billion projects. And we need a lot of them to have a significant impact on the driving forces of energy security or greenhouse gases. We will be happy with what Ex-Im Bank has an annual cap of $100 billion. We may not get that much.

Because of those forces driving us we formed with AREVA, and that's a French company but we're dealing with their US subsidiary, UniStar Nuclear. And from day one we said we're doing this to facilitate the deployment of at least four US EPRs. You'll enjoy this. In France they're European Pressurized Reactors. In the US they are US Evolutionary Power Reactors (laughter).

We're teamed with Bechtel as the architect, engineer and constructor of the fleet.

We are hard over on standardization. My boss says, down to the carpet and wallpaper. Mike Wallace is the president of Constellation Energy Group and he was at Commonwealth Edison as maybe the last executive still engaged that built plants when the last wave was built. He was responsible for building four units at two stations, Byron and Braidwood.

Interestingly, his counterpart on the NSSS side was Tom Christopher, who is the president of AREVA US. So those two guys did it before. And they attempted to create absolutely standardized plants, did not quite make it. They absolutely intend to do it this time.

You'll see a business model. UniStar Nuclear's business model is not about building a few projects. It's about creating a company, which I'll describe to you, to support the creation of project companies which would be jointly owned by Constellation and its energy partners.

There is the ownership structure of UniStar. Areva and Constellation created UniStar Nuclear. That's a marketing shell designed to help with the deployment of these companies. Through UniStar Project Holdings we will then want to take equity position in this fleet of at least four US EPRs. Quite frankly there is one that now is underway in licensing where we don't yet have an equity position. It's 100 percent owned by a company that's building it into a rate base.

We would love to own 25 percent of that. But we will, with them, for Nuclear Operating

Services Company, and that will be a co-licensee and an operator with the project company for that plant and for all of the UniStar plants.

Standardization doesn't stop with design or just with construction practices. It has to go through operations with common operational practices and procedures and procurement.

We formed UniStar Procurement Company because we want to take advantage of the economies of scale associated with procurement. And to with some kind of serious, intellectual capability manage the tough list for global procurement that is going to be involved with this.

UniStar Development Company really has two functions. It's a single company that will secure the license for these plants, built under the reference license, and then manage the EPC contract with Bechtel and AREVA.

We're talking to a bunch of people about potentially being equity partners with us.

Strategic partners are those that operate currently nuclear power plants. They understand the business of plant operation. We currently operate five units and so we will bring to the bar this notion of operations as a fleet discipline. Some of our strategic partners are folks with just one unit. And they really do want to become part of the fleet because their economics aren't as good as people secure from the advantages of a fleet.

There are some passive owners of current generating nuclear plants that would like to broaden their footprint.

We're talking with municipals and co-ops.

We're even talking to developers. The folks in Fresno. We're talking to other developers in West Texas out of Amarillo. Developers typically bring land and water to the bar.

They bring an intimate knowledge of local support and relationships that could be useful in securing a line of sight to power purchase agreements. And they bring an intimate knowledge in some cases of transmission access to get the job done. We bring nuclear operational expertise. And together we can secure both the equity and the debt if we get the loan guarantees right to move ahead.

We're focused on gas-dominated

marketplaces. We would build, and we would partner with somebody in a rate-build situation as opposed to a merchant situation.

A year ago you may recall Constellation contemplated a merger with Florida Power & Light. Florida's a hybrid since they have regulated nuclear power plants and merchant nuclear power plants like Seabrook.

When you do the pro formas the bottom line is kind of interesting. The difference is in a merchant situation with reasonable market prices you wind up securing that asset at a return on equity at risk about twice as high as you can secure return in a rate-base build.

And it takes -- Well the rate-base build takes about two and a half times the equity. Because in the merchant case if they get the energy policy right, the rule making right, I'll be off balance sheet leveraged 80/20. On balance sheet it's 50/50. And that rate of return was based on a 12 percent return on prudently incurred book value.

I've got to tell you though, a 14 percent rate of return in a regulated environment with the rate payers taking risk is not a bad deal for a company. So it's the balance of risk and reward as we see it. Our business model is that of a competitive merchant supplier. We would prefer to take that risk and move forward.

ASSOCIATE MEMBER GEESMAN: But you don't have as deep a pocket to absorb risk as the regulated model.

DR. TURNAGE: And it's got to be off balance sheet, prefer that. If we get the rules right on federal loan guarantees it's absolutely non-recourse to the parent. And quite frankly, we're still small enough -- We're about a 15 billion market cap company. We're still small enough, we're going to need equity partners to do what we aspire to do.

ASSOCIATE MEMBER GEESMAN: And you're relying on vendor guarantees to absorb most of your construction risk?

DR. TURNAGE: The EPC contract, we will rely on risk allocation, mostly among AREVA and Bechtel. There's a gap that we may have to fill. And we have not included risk allocation at the EPC. As you know it's a huge issue.

Here's kind of the driver from a kind of economic and public policy perspective that came out of the Energy Policy Act. I'm going to go through some parametrics just to give you a sense of the significance of the various incentives of the EPAct and how we think about this as a merchant supplier.

Cost numbers. this is an overnight cost, about $2,000 a kW. I want to tell you two things about it. One, it was developed in a fairly granular fashion. This is a plant being built in Finland. We understand its design. We know in detail the quantities of material that go into that plant. There are 19,000 line items defining quantities in this estimate, okay.

We got labor rate, productivity and cost data from Bechtel, our partner. That's based on Southeastern US labor rates. A little bit cheaper than in California. The second thing I want you to know about this is it's wrong. I did this at the end of 2005. And since then commodity costs have streamed upward. We are redoing this analysis. My best guess at PJM an overnight cost would be for this plant is more like $2400 a kW.

But for the purposes of parametrically looking at the Energy Policy Act we'll stick with this as a base case so you can see how the various incentives affect in terms of the deltas.

Here is the base case. This is a big plant, 1600 megawatts electric. There's an implication for that by the way. We won't be deploying this fleet in many places of the country without transmission upgrades of some significance.

We're assuming that this is 2009 to 2015 construction financing, it's leveraged. We'll take it out, it'll still be leveraged.

I baked into this an 18 percent return on equity at risk. That is not a hurdle rate, don't go there. But I wanted a number that produced very nice, minimum debt service coverage ratios. So when I talk to lenders they're at least on the same page with me for a little while.

I get the federal loan guarantee so I get debt at Treasury plus a smidgen.

I'm assuming that the price of the subsidy cost is one percent. That's pretty aggressive. I think actually the default probability of these plants, particularly if you propose that there's a refi and the loan guarantee not be there forever, is maybe less than that.

But I don't know how it's going to play

out at the end. I do think subsidy costs, the size of the overall authorization cap and getting the rules right are the three heavy lifts that have to be aligned for us to be successful. I assume one percent a year.

Half a percent loan origination fee.

I get all of the production tax credits. Not going to happen. But in this base case I get everything. I get the loan guarantees, I get all the production tax credits.

This is a plant, by the way, that we are very attracted to. Operationally it is the most neutronic and thermally efficient plant of the new generation. Because it has four completely independent safety trains of cooling you can valve one out operating at 100 percent hour and do on-line maintenance. Because of that nominal outages are like 11 days. So it has a very high average capacity factor.

It also, I'll just share with you, is the only one of the new technologies -- The Finns did this, it's outside of our design basis. It's explicitly designed for commercial as well as military jet aircraft impact. And it's also designed with a core catcher so that in the event of any accident scenario there is no detectable radiation release to the public. Now you pay for that. It's probably the most expensive of the reactor designs.

If that's the base case what do I need from the bus-bar? I need $37 a megawatt hour. It's baked in at 18 percent rate of return. I get everything, all the production tax credit, I get federal loan guarantees. And so I'll call this the most optimistic future that you could have and it is a very attractive future.

What happens if I don't get that? here's some sensitivities. Last year when I did this DOE was talking about 80 percent of the 80. So scenario one is I only get 64 percent of the debt guaranteed. Now assume that any second tranche debt would be priced like equity. Today's proposal is for 90 percent of the debt so it's about half this impact.

Under scenario one I lose $11 a megawatt hour and I had to recoup that from the market and therefore I need $51. So I lose $14. So you need $51 a megawatt hour to get my 18 percent ROE.

This was not intuitive to me. I did the case with no production tax credits at all. How much do I lose? Eleven dollars a megawatt hour. So the 80 of the 80 was worth as much as all the production tax credits. If I did it again at 90 it would be worth half the production tax credits. And since I don't think you're going to get them all, you're going to get more like half since they're capped at 6,000 megawatts, I view the proposal of the second tranche debt to comparable loss of value as if I did not secure production tax credits.

Scenario three is I get all the production tax credits but no federal guarantee. Without a federal guarantee I can't do 80 percent debt projects. All right. I'm on balance sheet. It's going to look like 50/50 debt to equity. It costs me 432 a megawatt hour. So federal loan guarantees in this analysis are worth about three times what production tax credits are in a merchant business model.

If I don't get any production tax credits or federal loan guarantees, if the Energy Policy Act had not passed, I'm around $80 a megawatt hour. And if you recall earlier from the Keystone Center, their total number -- we disagree a lot on the individual pieces of this. Was if I recall, between $83 a megawatt hour and $111 a megawatt hour. If I update my capital costs I'm going to be in their range. And we probably would not go forward. If the Energy Policy Act had not passed, if we cannot get access to loan guarantees, we're going to have some difficulty with this business model.

Dennis Spurgeon of DOE took these numbers and he flipped them. I thought interestingly. And he said, you know, the difference between the $80 that you'd get, you'd need to get from the market, if the Energy Policy Act had not passed to return to the investors as 18 percent, and the $37 if it passes and you get everything, is a pretty big delta representing potential rate payer value. And the number is $575 million per USEPR per year.

But I think my point is, without the Energy Policy Act we probably won't be building these plants.

The bottom line. A snide comment by me, apparently not understood by OMB and Treasury. It used to say and DOE but I won't say it today. It's mostly important, the second thing. Don't think about the loan guarantees as an only, as a subsidy for a project. We need a financing platform in order to access debt at reasonable rates. And even more importantly, to leverage our equity.

That 81,000 megawatts of new nuclear plants. The entire market cap of the nuclear industry is about half of that of Exxon-Mobil. My company, $15 a year. How many of these can I build on my balance sheet? One. So to do the heavy lift if you really are serious about nuclear having an impact on global warming or energy security it's going to require a financing platform made possible by the federal loan guarantees.

We've got a lot of challenges. By the way, I did read the executive summary. I haven't read the 350 pages of the MRW report. And I think we see the challenges in a very similar way. I think it was a good discussion of the heavy lifts that have to go.

I tend to see, and I think my company tends to see those issues as a glass is half full rather than half empty. I think it's probably because we spent the last two or three years seriously working and investing to figure out how we can manage these challenges. And I will tell you, we've got a line of sight, we believe, on every significant challenge except the federal loan guarantees. If that comes down correctly we're going to be pretty good to go. But there are a lot of challenges.

We just talked about rulemaking.

Financing, we talked about the need for leverage. There will be financing available for us with the federal loan guarantees. I could even deal with the that secondary tranche debt if I can fix the pari passu and the stricken.

The first wave of these plants, it doesn't matter if it's Toshiba-Westinghouse, Toshiba, Hitachi-GE, GE, or AREVA. The content of the first wave of these plants is going to include both French and Japanese content.

Coface, the French Ex-Im Bank equivalent, and JBIC, the Japanese equivalent, absolutely prepared to loan into these projects at very attractive rates. They are not going to do it unless we fix the pari passu problem. So it's all about getting the rules right in the federal loan guarantee.

Public perceptions. People are more

positively disposed to nuclear today than they were five years ago. I think in general in local communities they're very positive. But I think it's one micro deep, as my friend John Sununu said.

I think that an important issue will be continued safe operation of these plants. If there is any significant serious problem with the existing 104 reactors in this country this program is stopped, or certainly set back.

Infrastructure is a big problem. We're having to source components externally. We have agreed with AREVA that our target is to source 80 percent of our content through US sources, cannot do that today. It's worse than the forging story because we can't even do the ultra-heavy forgings. Only one place in the world for any of these advanced reactors, to get those are Japan Steel Works. So the development of US infrastructure. And I'd broaden that to include transmission infrastructure, represents challenges.

And it's not just materials, it's the labor pool as well. And we've got to pay attention now to that.

We are in discussions with the president and the executive committee of the National Pipefitters Union. And we want to work with them to build an academic and vocational training institute, and we're partnering in this with our partner in Amarillo, Texas. Who interestingly enough is still a card-carrying fitter.

We've got to do these things now to create the labor pool of qualified welders and crafts people as well as nuclear engineers to support the development of these fleets.

We've got issues with the back end of the fuel cycle. And I think including those issues is a feedback loop to public perception because I think the public perception about the closure of the fuel cycle is extremely important.

Just a comment on closure of the back end of the fuel cycle. If you haven't seen the recommendations of the National Commission on Energy Policy, and perhaps you have, it's an interesting commission. It was a bipartisan commission of 21 folks. Interesting mix. John Holdren, who has the highest regard. Bryson of Edison. Ralph Cavanaugh of NRDC. Dick Meserve, who is on our advisory board and president of the Carnegie Institution and former Chairman of the US

NRC. These are not nuclear, wild-eyed advocates. There's a mix of folks here. This was their recommendation regarding spent fuel.

And if you look at it it's kind of my company's position. Which is basically, the government ought to take title to the stuff like they said they would and they ought to appropriately move it to some managed, retrieval storage facility as we figure out whether or not reprocessing is economic. Whether we can do it and manage proliferation risks. No need to rush to that judgement today.

When I go to our board for a decision to build -- a notice to proceed to Bechtel, one of the questions will be, what's the worst that can happen to us as an investor. And quite frankly, the worst we can price in. It's to build an on-site, above-ground retrieval storage facility and have these big concrete canisters sitting up there. And I can price that out and they'll be good to go for more than the life of the project.

So we don't view the waste disposal issue, or the need for Yucca Mountain or permanent disposal, any of that, as relevant to the investment decision we can make to build a plant that can return significant values to our stockholders and to rate payers.

In spite of the challenges we think the opportunity is real. I stole this from Jim Collins in Good to Great. Our company does have a passion for the work. We are a fleet operator, we're proud of it. We're proud of the operating experience in our existing fleet. In fact it's been improved as we've grown the fleet, mostly through acquisitions. We think we can be the best and we think we can make a buck at this. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you, Dr. Turnage. Questions?

ASSOCIATE MEMBER GEESMAN: How do you feel in terms of your construction risk exposure in your pro forma in view of the experience with the AREVA project in Finland?

DR. TURNAGE: Good question. First of all, we've been, of course. Since we're a customer we get to go. We've been to Olkiluoto 3. We have also signed a technical assistance agreement with Électricit, de France. We will participate in their construction program and -- a second one of these units is being built in

Flamanville, France. We will participate in their construction program and in their commercialization start-up program. That will occur before our plant goes forward.

We understand most of the issues that occurred in Flamanville. They began with the fact that like we did in the past they started constructing a plant that wasn't design finalized. It's exacerbated by a prime contract with AREVA and gazillions of small entities separately contracted so the management problems in that spaghetti network of relationships is very difficult.

They did not pay attention to the realities of what I'd call serious attention to nuclear gray level quality assurance with Finnish regulator who is extremely tough. So they poured concrete out of spec and they were stopped work for about six months until they figured out that that really was not a problem.

So hopefully we will take advantage of the lessons learned in Finland and in France and with our constructor get real smart about that. We will have design finalized before we construct. We're spending about half a billion dollars to do that. This is beyond the design required for certification. This is getting to constructability and having an absolute, underlying, standardized approach.

I should have said, baked into that overnight capital cost is another aggressive assumption. It assumes we can do as well as EDF did when they constructed their N-4 fleet. And that represented from their first unit to the fourth, not quite but almost a 20 percent reduction in cost as they went through a construction learning curve. The Japanese call it continuous construction.

So the idea is it represents a risk. We're trying to get real smart about it. You might appreciate that our board requires the fall. Give me the doomsday scenario. Costs go up by 50 percent. Construction lags a year. Market prices go down by $10 a megawatt hour. And roll it all up and what does that look like? It looks like between four and five percent ROE. You'd never do that, but you don't bankrupt the company.

ASSOCIATE MEMBER GEESMAN: And just to revisit the cap question again. Your business model is premised on receiving the federal guarantee for each of your four projects, is that correct?

DR. TURNAGE: That's correct.

ASSOCIATE MEMBER GEESMAN: Then finally, you mentioned that you really depended upon no adverse safety problems with 104 existing US reactors. Isn't your trip wire in fact an international one?

DR. TURNAGE: It may be. I think if there were some totally dissimilar design plant having a problem like Chernobyl that's a slightly different story because there's lots of problems but it's probably not fatal. I think if it were one of our plants it would be a disaster for us.

ASSOCIATE MEMBER GEESMAN: I want to thank you for a very candid presentation, I appreciate it a great deal.

DR. TURNAGE: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Dr. Turnage, just on that last question on whether something happening abroad might affect your ability to continue your business. You mentioned the public attitudes being a micron deep. It seems like something like that could really turn around public attitudes.

DR. TURNAGE: I agree.

PRESIDING MEMBER PFANNENSTIEL: I want to make sure I understand the business model that you were describing, though. You have the merchant model, so it's not dependant on rate-base treatment. But it is dependant on federal loan guarantees?

DR. TURNAGE: That's correct.

PRESIDING MEMBER PFANNENSTIEL: All right. Now if those did go away when you were into the business and defined your plant were ready to go, might you then go looking for an opportunity to work in a rate-based environment?

DR. TURNAGE: We will consider a rate-base build with a partner. Again, it's financial attractiveness is not as great for us. We are prepared to take the merchant risks to achieve those returns. But I would not exclude that and we would consider having a rate-base partner.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Other questions? It's late in the day, thank you very much.

DR. WEISENMILLER: Commissioners, I know it's late in the day. Allow me to introduce our last speaker. We have Tom Cochran. Tom is the director of the NRDC's nuclear program and he holds the Wade Greene Chair for Nuclear Policy at NRDC. He has been at the NRDC since 1973. It was a huge favor from Ralph to have Tom fly all the way out here and give this presentation. So certainly next time you see Ralph please thank him for the Commission.

And as I indicated, Tom was on the steering committee of the Keystone Center Report and certainly can talk about stuff. We've given everyone his bio. I could go on for a long time about his background and qualifications but I think given the hour it's better to let Tom speak.

DR. COCHRAN: Madame Chairman and members of the Commission, I want to thank you for this opportunity. I've given you a longer, written statement which I will not go into in detail. I want to highlight a few issues. Many of the issues that I covered in the statement have already been covered by others.

But the first issue is the role of nuclear power in reducing greenhouse gases. I just want to make a, reiterate a couple of points. We have about 441 nuclear plants globally today producing about 370 to 380 gigawatts of electricity.

If you hypothetically assume those operated continually for 50 years that would be roughly equivalent to one of the Socolow wedges, a little over a wedge. And because they are going to pass through their license lifetimes in that 50 year period, if they are not replaced you'll lose about a half a wedge. This is on a global basis.

Now I've given you a lot of detail on our attempts to estimate just what the growth rate is likely to be, both in the United States and globally and you can look at the detailed derivations. But our best guess is that globally over the next 50 years it would be something on the order of 215 to 270 gigawatts of new, nuclear capacity and in the US somewhere in the roughly 25 to 30 range.

There's one huge uncertainty in all of this and that is what happens to these plants, particularly in the US, when they reach the end of their next license extension. Most of them are getting extended and I'm assuming all of them get extended from 40 to 60 years. But between 2035 and '55 they come up again.

And I think there is going to be

enormous pressure given the fact that they produce on a forward cost basis low-cost electricity. There will be enormous pressure to relicense them and that has obvious implications in terms of safety because of the aging issue. But we've assumed in these numbers I've given you that that's either relicensed or replaced.

I won't go into the economics. Most of my recent knowledge of that comes from the Keystone Center report and Jim has already covered those issues.

On the safety issue. Again that's been covered, at least from my perspective, largely by David Lochbaum, who spends more time on those issues than I do. But my own judgment is that the existing fleet of reactors in the United States is clearly safer today on balance than they were 20 years ago or prior to Three Mile Island or whatever date you want to pick.

The new generation of plants appear on paper from PRA analysis and so forth to be safer than existing plants in terms of their design. The problem with PRA analysis, of course, is that there is no way to really verify the calculations. Numerically the absolute numbers don't mean a whole lot but they give you some relative perspective.

I believe the most important factor affecting the safety of nuclear plants is the safety culture at the plant. We've heard a lot of discussions of that today. The point I would want to make is that there is a real lack of an adequate safety culture in many countries and in some, very few but at some plants in the United States. And we heard testimony to that effect today.

Most of the new plants that are being touted to go in over the next couple of decades will not be in the US but will be in countries where either our knowledge of the safety culture is nonexistent or certainly questionable. And many of the countries that operate these 441 plants have an absence of an adequate safety culture. So I think if we are to see another major nuclear accident, and we all hope we won't, that it is more likely to occur elsewhere in other countries than it will in the United States.

Let me turn to the issue of spent fuel. Clearly some amount of spent fuel and high-level nuclear waste can be safely stored at Yucca

Mountain. The problem is we don't know whether that amount is larger or smaller than the legislative limit of 70,000 tons.

My criticism with the whole -- Well I have many criticisms about the Yucca Mountain licensing process. But I am really deeply troubled by the behavior of the Environmental Protection Agency over the last 25 years in developing the standards. Actually these standards don't go out of EPA before they first go through a secret, internal review process in the White House that involves DOE and NRC and OMB. And so what comes out is really not an independent regulatory agency but it includes the applicant. Bizarre if you had that in some of the other -- Well I guess we do have that in some of the other regulatory regimes.

But the EPA has systematically -- Well let me back up. When you think about protecting future generations there are really three factors you have to play with. What radiation exposure dose are you going to allow an individual in the future? Where are you going to make that measurement or model that exposure? How far from the engineered repository? And over what period of time are you going to apply that criteria?

The Environmental Protection Agency has basically corrupted each of those parameters. They first cut off the time period at 10,000 years because that allows you to rely heavily on the engineered canister rather than the geology of the site.

They gerrymandered the control boundary, the point at which you would measure compliance. So that unlike the WIPP facility where it is five kilometers in every direction, in the direction that it leaks out of Yucca Mountain they extended the control boundary from 5 to 18 kilometers. It allows the aquifer coming down from the north to dilute the waste before you have to measure it to see if you're meeting the exposure standard. We raised that in court in a lawsuit because of the deference given to the agency.

When the court ruled that a 10,000 year cutoff was not consistent with the congressional mandate that it be consistent with the National Academy of Sciences' recommendations EPA's response has been to propose a two-tiered dose limit, retaining the 25 millirem for the first 10,000 years. That's a limit on the mean dose to a maximally exposed individual.

But after 10,000 years they increased it to 350 millirems but on the basis of the median dose, which is one-third of the mean dose. So the mean dose is actually more like a rem per year to the maximally exposed individual at this gerrymandered boundary.

And to just put the number in perspective. If that were the lifetime exposure to a person today, 1 in 12 people would get cancer from that exposure based on the National Academy of Sciences' best estimates in the BEIR VII report. And half of those exposed would die of cancer.

So in summary -- Oh, there is one other point on the Yucca Mountain. The Department of Energy when it makes its application to the NRC and the NRC reviews its application there's going to be a lot of modeling to see if these dose calculations -- dose limits are met. And the DOE computer code is so large that the NRC will not be able to operate it. So it's a black box. But the NRC will build its own code, not for the purposes of licensing the plant but for the purposes of knowing what questions to ask the DOE and the DOE code will be the official calculations.

Let me turn to -- Finally on the spent fuel issue. I believe aged, spent fuel can be safely stored in dry casks as long as you want to manage the casks. And, you know, the utilities around the country are turning to dry cask storage as the wet pools fill up. I think 30 out of the 65 sites in the US have dry cask storage. Another 16, I believe, have applied for the licenses and there are others thinking about it. So everybody is going to be moving in that direction. I don't think it's necessary to have centralized dry cask storage except I think it makes sense for decommissioned sites that have been decommissioned.

The troubling aspect, of course, is that this may be the de facto, ultimate solution to US and even global spent fuel, despite the fact that the US policy has been, the government policy has been not to rely on institutional controls for more than 100 years.

On the proliferation issue, which I think is the most important issue confronting the civil nuclear power industry. Per Peterson I thought did a very good job of identifying sort of the four categories of issues that have to be addressed and controlled.

One is, potential for diversion of materials from a facility for weapons purposes.

The second is the potential that a non-weapons state would develop clandestine facilities such as similar to what Iran where it secretly built an enrichment plant, I think for weapon purposes beginning in 1985 and it wasn't discovered until a few years ago.

Third is the breakout potential, such as you saw in North Korea where a country signs the non-proliferation treaty and safeguards agreements but then reneges and uses its facilities for weapon purposes.

And finally the non-state threat of terrorists using fissile material. Here I think the greatest risk is highly enriched uranium, not plutonium, because it is more dispersed, less well-secured, easier to work with, easier to make a bomb out of. The only advantage of plutonium is it has a smaller critical mass so you need less of it but it is much harder to fabricate something of equipment yield. So the real risks there are associated with research and test reactors and not with these power reactors.

On the proliferation front the problem is that the international safeguards regime, and that includes the non-proliferation treaty and other treaties and the IEA safeguards. The safeguards are not capable of safeguarding what I would characterize as bulk handling facilities, namely uranium enrichment plants, reprocessing plants, mixed oxide fuel fabrication plants, plutonium storage facilities and highly enriched uranium storage facilities.

Therefore the only way this technology can go forward safely from a non-proliferation standpoint is if these bulk handling facilities were limited to weapons states. I would add, eliminate the unneeded closure of the back end of the fuel cycle and that entails reprocessing and MOX plants.

Now we've heard some testimony and you had some questions related to the Department of Energy's Global Nuclear Energy Partnership. In my view that vision as it relates to the back end of the fuel cycle is absolutely doomed to failure. It cannot work. It will not work. And that's because it's based on the marriage of two failed technologies, reprocessing and fast reactors.

Reprocessing has failed in some countries technically and failed in all countries economically. And there is no foreseeable point in time that you could say that this is going to be, reprocessing will be economical. Jim Harding gave you some figures earlier on the economics.

Technology has changed. It's also sort of the dirtiest part of the nuclear business, the reprocessing industry. Not necessarily in every case but in most cases.

The real reason though that GNEP is doomed to failure is because you have to have a large fraction of your reactor fleet domestically and globally fast reactors in order to transmute the plutonium and transuranic elements to gain the benefits of reduced waste management requirements.

The world has pursued fast reactors since 1946. It's been pursued primarily to develop plutonium breeder reactors. But it's been pursued and failed in the United States, in France, in the United Kingdom, in Germany, in Italy and in Russia.

I add Russia, although it has two operating fast reactors, one commercial sized. It operates it on highly enriched uranium. And it never closed the fuel cycle and stuck the United States with a half a billion dollar a year fee to provide the security for 34 tons of plutonium and other materials that were not adequately safeguarded when the Soviet Union collapsed. And not so radically safeguarded today.

Out of about -- By the way, it also failed in two nuclear navies, the United States nuclear navy and the Soviet navy. When Admiral Rickover tried to build one land-based prototype and then put a sodium-cooled fast reactor in the Seawolf before it went on sea trials he had already decided to jerk the reactor out. And I have in my statement a nice quote from the history of the nuclear navy. And I'll just quote the very end of it, the reason he pulled it:

> "In Rickover's words they were expensive to build, complex to operate, susceptible to prolonged shutdown as a result of even minor malfunctions, and difficult and time-consuming to repair."

And this has turned out to be the history of fast reactors in the world.

The flagships of all of these countries that I have mentioned with the exception of Russia have been failures. The US and German, the Clinch River and the Kalkar reactor in Germany were canceled prior to doing construction.

A lot of people point to the French program as the hallmark of excellent, nuclear operations and closure of the fuel cycle in La Hague, how well it works. The Superph,nix operated for 11 years with a lifetime capacity factor of 6.6 percent. The previous Ph,nix, which is now run as an R&D facility, was running one sodium leak a year for 20 years of its life.

The Monju reactor, the flagship of the Japanese program. It's been shut down since 1995. It has a lifetime capacity factor of 0.4 percent and decreasing. There's probably a lot one could say about problems with the Russian program if they weren't secret.

So the one thing we did learn from fast reactor development, and we primarily learned it from the Superphenix, was that in France where we didn't have the great cost overruns of building this standardized fleet of plants, fast reactors in France cost 30 percent or more than thermal reactors, than the French PWR. And that was with a pot-type design that the US rejected because of maintenance concerns but it was a cheaper design.

So the Department of Energy's Global Nuclear Energy Partnership is based on the theory that in a market economy energy generating companies are going to opt for a fast reactor that has a much higher capital cost and operating cost and has a potential reliability of about 50 percent based on the 25 or so plants that were built. And that they would opt for that instead of a thermal, light water reactor that they have a track record of 90 percent capacity factor. I don't think so.

So I think this program is dead, at least in terms of ever showing any useful benefits. Instead what is happening is the Department of Energy in order to get support for this has internationalized it, made it an international partnership and will be promoting the development of hot cells and cadres of experts in plutonium metallurgy and actinide chemistry in non-weapon states such as Japan now and others will follow. So the program is increasing the risk to US national security and will not decrease it.

I just want to make one final summary remark that is not in my written testimony. This is a nuclear energy -- It's the only technology, energy generating technology that requires national and international treaties and obligations to prevent people from making nuclear weapons with the fuel.

It's the only technology in the US that requires the federal government to subsidize the risks associated with catastrophic accidents. It's the only technology that requires federal governments to manage the waste products because they are dangerous and the materials from them can be used for nuclear weapons.

I marvel at this industry. Every single problem that it faces it has fostered off on the federal government. If it's proliferation, that's a State Department and a Department of Energy problem. The utilities don't have to deal with that.

If it's a waste problem, that's a government problem. Give the government the obligation to deal with the waste and then sue them when they don't meet their obligation.

If it's a safety issue. Well, we'll get the government to subsidize the cost of the insurance because otherwise we won't build these plants.

And then finally after this technology is mature and we're extending the licenses of the operating plants, they're back to the federal government trying to get subsidies. Having gotten subsidies and will try to get more, because they are uneconomical.

Now we have a global warming problem. That is the central, most important problem facing the planet. I didn't go to the Sloan School of Management. I'm a physicist, I didn't take economics, but I know this: If you want to address a pollution problem, an externality where people are polluting the planet for free you have two options that are economically efficient. One option is to limit the emissions, cap carbon. The second option is to tax it until the emissions are reduced.

Instead you have this industry having gone to the Hill to get $10 billion, $13 billion worth of subsidies for their favorite technology. NEI will not advocate capping carbon. NRDC will.

Capping carbon is the single policy that will do the nuclear industry the most good in the long run, capping carbon. So I like to tease my friends from NEI by saying, who is more pro-nuclear, NRDC or NEI? We are for capping carbon and helping the nuclear industry.

But I do not think this industry should be allowed, it's a mature industry, to go to the Hill and get more subsidies that will penalize technologies that can get us carbon relief faster, cleaner and safer than this technology. Thank you. I'd be happy to answer questions.

PRESIDING MEMBER PFANNENSTIEL: Thank you, Mr. Cochran. Thank you so much for coming here and for your excellent statement. I did have a chance to read it earlier today and I thought it contained a lot of incredibly useful information.

Are there questions from the dais? Commissioner Geesman.

ASSOCIATE MEMBER GEESMAN: I want to thank you for being here as well, Tom. Does NRDC believe that it should be a matter of national policy to accelerate the movement of spent fuel from the pools into dry casks?

DR. COCHRAN: Yes.

ASSOCIATE MEMBER GEESMAN: Thank you.

DR. COCHRAN: That was easy and quick. (Laughter).

COMMISSIONER BOYD: Perhaps another easy question. I think you said it's, I don't want to speak for you, safe to leave things in dry casks. But here in California we have two decommissioned plants, one right here in Sacramento that has a dry cask storage facility but nothing else there, and one that was mentioned earlier today up in Humboldt where they're starting a dry cask facility. And then we have two operating plants that you heard about today where they either have or are building dry cask facilities.

Then we get over to Yucca Mountain. You courageously said that Yucca Mountain might be good for awhile for some undefined amount. But setting that aside for a moment. It was mentioned here once today, and frankly it's been mentioned many times, and particularly to me many times, the idea of a somewhat centralized facility to move materials to something that above-ground perhaps can be managed for a couple of hundred years. Where hopefully maybe man in his ever-accelerating wisdom I hope can figure out some better solution.

And then we here on the west coast do worry about seismicity of our state and what have you and some question the wisdom of leaving dry casks sitting around California. So I just wonder if you have a view that there is possibly a mixed approach to interim storage. That in some regions it might be wiser to move to some interim storage facility and other regions where the geology hasn't proven to be particularly solid.

I don't want to pick on the east coast but that was a pretty safe place until they suddenly decided on Yucca Mountain. So I just wonder if you have a view on that subject.

DR. COCHRAN: As an organization we haven't developed a view but I'll give you my personal view. First of all I think it's nonsense to think an earthquake is going to damage a dry cask storage container. I think you can shake those as long as you want to and you're not going to -- you may want to go back in and re-rack or something in a safe facility but I cannot envision it being shaken open. So I don't think that's an argument, seismicity, for moving dry casks.

I think it makes sense to have a place to move spent fuel and store it in dry casks from sites you want to decommission so you can make them greenfields and the company is not left holding the bag at that particular site.

I don't think there's a strong argument for centralized storage to manage the dry cask storage that's currently taking place at the operating reactor sites. In the first place it's already there and you're building these things and you're licensing them.

There may be an economic argument some time in the future, I don't think it's there now for some sort of centralization. You run the risk though if you move huge amounts to a central storage site that it becomes a de facto above-ground repository. So I would not favor that particular option. But I have no problem with moving the Humboldt waste to another site.

COMMISSIONER BOYD: Thank you.

DR. COCHRAN: And I think it could be transported safely.

COMMISSIONER BOYD: Thank you, and thank you very much for being here today and being willing to stay so late. I would observe sitting up here that we haven't lost a soul from the audience so you're a great attraction (laughter).

PRESIDING MEMBER PFANNENSTIEL: That's because, Jim, they've all given me blue cards (laughter). We have a lot of --

Thank you, Mr. Cochran.

DR. COCHRAN: Thank you.

PRESIDING MEMBER PFANNENSTIEL: We have a lot of people who have asked to speak and we have more. I would ask a couple of things. I'll call the names on the blue cards in pretty much the order they were given to me. The hour is late. And the point of speaking is to address us and to build the record, probably not to dazzle us with your eloquence at this hour. I think probably we're beyond that.

But we would appreciate people who would like to get information into the record. I know that there are a number of cards here from people who have already addressed us this subject on Monday. So obviously you're welcome to come up but I would ask if you have,if there is nothing additional to put in the record why don't you just let us know that you're here. But we'll start with Lloyd Cluff.

MR. CLUFF: Thank you, Madame Chairman Pfannenstiel and Commissioners. My pleasure to be here today. I am Lloyd Cluff with Pacific Gas and Electric Company. I am director of PG&E's fuel sciences department. I joined PG&E in 1985 to manage the comprehensive seismic safety reevaluation of the Diablo Canyon power plant. And also was given the responsibility for managing all earthquake risk for PG&E's corporate facilities. And while Chairman Pfannenstiel was there I worked with her on retrofitting one of our major office buildings.

What I wanted to share with you, in addition I have worked in the field of seismic safety for more than 45 years on nuclear power plants and dams and port facilities all over the world and have a lot of experience and have investigated a number of large, damaging earthquakes worldwide.

And I just wanted to put on the record my concern and cast some shadow on the presentation made by Rochelle Becker earlier today. During the long-term seismic program that I managed for seven years on Diablo Canyon it was a very open process. I chaired over 47 public meetings. Rochelle Becker came to a lot of those meetings, made comments at some of them. And her style of making presentations often leads to mis-representation of some of the data.

I just want to pick on one slide that she showed that has to do with the seismic history. It was slide 16, California's seismic history, where she stated on the slide that there have been 39 worldwide earthquakes listed in the US Geological Survey site and out of those worldwide records 21 occurred in California.

When you look at the US Geological Survey website you find that there have been 500 worldwide earthquakes of magnitude greater than six that qualify for significant earthquakes and only eight percent of those occurred in California. More have occurred in Alaska and other places. I don't --

Earthquakes really are not an issue at Diablo Canyon. I just wanted to use this as one example of a misrepresentation of factual data that is in the US Geological Survey database. Thank you very much.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Doug McNea.

MR. McNEA: Hello, I'm Doug McNea, nuclear worker. My background started in 1970 when I started to attend the Navy Nuclear Power School at Mare Island and from there went to the S5G prototype in Idaho. And from there eventually to spending three and a half years working in very close proximity to a nuclear reactor aboard a fast-attack submarine.

After I fulfilled my obligation to the government, to the US Navy and was discharged I went to work for a small firm in San Jose that does R&D testing and consulting for the nuclear industry and has done a number of contract projects for EPRI and directly for the utilities.

And as part of that over my 37 career in nuclear power I have had to go to -- I have probably been to close to 50 nuclear power plants in the US, one in Canada and one in Sweden, actually performing complex testing of turbine performance using radio tracers that required coordination with the plant people. And I think it sort of gives me a unique perspective in terms of working in the regulatory fishbowl that nuclear power is.

I have been also in the commercial nuclear industry. I have been witness to the ratcheting up for the change. I mention both my

Navy and civilian experience because when I got out of the Navy and started working in the commercial field there was a giant chasm between the culture of safety in the Navy and the culture of safety in the commercial nuclear power industry. That culture of safety in the nuclear power, we have to thank Admiral Rickover for that because his culture and his legacy lives on.

There has been a lot of mention about INPO. I understand that the first head of INPO also came with a Navy background. And all the power plants I have been to, there's several people that like myself got their start in nuclear power from the Navy. The commercial nuclear industry really owes a debt of gratitude to Admiral Rickover on that training and that culture of safety.

On that there's been discussions about the plant design and designing safely. There is a great need for that. But as in the Navy we used to say, there's nothing that's sailor-proof. And because of that, when it comes to safety the buck stops with the nuclear worker.

Training has progressed immensely and one of the things contrasting the Navy to the commercial industry that came out in the nuclear accident was prior to Three Mile Island there was no real emergency -- In the Navy on a nuclear submarine the captain could come back there and hit the SCRAM breakers, shut the plant down. And we actually had to recover from that SCRAM incident or any other incident. We were actually working with a real reactor, reacting to an emergency situation.

Now in the commercial industry up until Three Mile Island there was no requirement for simulators. After Three Mile Island all plants are required to send their operators to simulators where they get some real accident scenarios where they have to react. Reacting to an incident, as Three Mile Island showed, you've got to see what's going on and react to it.

And if you've been drilled, like we were in the Navy. Because another thing that was different between the Navy in terms of the oversight is the Navy uses every ship, nuclear-powered ship goes through what's called ORS, Operation Rack for Safety Inspection.

And people that -- this is one of the contrasting differences is the person that -- The team that comes on board to perform this inspection is people that are experienced. They have gone to naval reactors, they have come from the fleet. They came from the fleet, they have actual experience, whether they're enlisted men or officers. They have actually been out in the fleet and had hands-on operating experience.

Unlike the NRC which has to recruit because they have had a policy from the beginning that they didn't want a revolving door policy where people went from the industry to the regulator, back to the industry. And I can understand that philosophy and that's why there's a real need for the INPO-type thing because of that.

But also because of the nature of going from plant, to plant, to plant. Some years I have gone to three or four plants and had to be badged for unescorted access. This comes in both the plant safety training and the security issues.

First in plant training, there is the safety, the culture of safety. All of the plants come with this principle of STAR, stop, think, act, review. If government officials used that criteria we'd be a whole lot better off, mainly on the review issue.

And the other thing is peer pressure. One of the things that's talked about INPO is it's only oversight, the ability to regulate is peer pressure. But we are also trained in peer checking. Because you need to look out not only that you don't make mistakes but that the person that you're working with doesn't make mistakes. This is another contrast that is becoming more and more prevalent in the commercial. There was a gap.

One of the things at Navy Nuclear Power School during the six months just before we left we were first told this. And this goes completely against military culture. We were told, and this was reinforced at the prototype qualified operators. That if you are ordered to do something that jeopardizes the safety of the plant you can be -- you can refuse to carry out that order and asked to be relieved of your watch.

And that is the ultimate safety factor is that if you are being told to do something that is unsafe that you can refuse to carry out that order without any disciplinary recourse.

And that culture has started to come

into the -- in going through the training at the different plants that culture has started to come into there too in that they're telling people, you know, you have the right to go -- first you go to your immediate supervisor if you have a safety concern. And if that supervisor doesn't address that concern then the phone numbers for the NRC and where the NRC office is at the plant, you're told to go there, go to the NRC with your complaint. So that's the stop-gap of safety.

Just briefly on security. Mainly because of some of the criticism of security on plant access. You have to go through several things to get unescorted access to nuclear power plants these days, and it's ratcheted up from the days when I first got out of the Navy. When you went to the plant all you had to do was have your good guy letter that said you were a good guy and they let you in the door.

Well those days are long over. You have to be fingerprinted. Your fingerprints have to be checked out with the FBI. You have to have your background checked. And then there's fitness for duty where you have to have a drug screening. And the restricted work hours so that you haven't worked 24 hours a day so your judgment isn't impaired by long work hours.

But the bottom thing, what was mentioned this morning was about the escort, how ridiculous it was that one person could escort a bunch of people. Well after 9/11 you can't even get on the owner-controlled area without going past a guard. And if your name isn't on the list ahead of time by somebody in the plant that's went all the way up to the plant manager that's authorized you to come on the utility's property, you don't get in.

And even if you're a visitor, because sometimes my work has required me to be escorted, you have to pass that criteria. So the idea that one insider is going to escort ten Al-Qaeda terrorists is ridiculous.

That pretty much concludes my comments. I just want to reiterate what I said before. When it comes to the real safety the buck does stop with the nuclear worker and there has to be a better appreciation. And public perception of the nuclear worker needs to be improved because, quite frankly, the public perception of a nuclear worker is a cartoon character named Homer Simpson. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you, Mr. McNea. Bob Woehl.

MR. WOEHL: I'm from the Electric Power Research Institute and I --

PRESIDING MEMBER PFANNENSTIEL: I'm sorry, we can't, you need to go to the microphone.

MR. WOEHL: I'm from the Electric Power Research Institute. We submitted some comments, I was just going to bring those to your attention. But I'll defer my time due to the late hour.

PRESIDING MEMBER PFANNENSTIEL: Thank you, Mr. Woehl. Ken Schrader.

MR. SCHRADER: I'm Ken Schrader, I'm a member of the North American Young Generation in Nuclear and I am also a proud employee to work at Diablo Canyon nuclear power plant. I'll cut down my comments here to allow other people time.

In the last year it has been quite a year for the nuclear industry. Around the world we have had several new countries that are starting to build new nuclear plants. In the US we have around 30 new plants being considered. The NRC has approved two early site permits this year for plants in Clinton, Illinois and Gulf, Mississippi and the Florida PUC adopted some pro-nuclear incentive packages. So we have seen a lot of things going on around the world and in the US.

In California though it has been a real different story. The California legislature has not been considering nuclear power as an option, as far as I'm concerned. And that was kind of shown recently when Chuck DeVore was presenting his bill to rescind the 1976 law banning nuclear plants, AB 719. He was cut off after about five minutes of presenting the bill and it was quickly voted down. So there is really no debate going on within our Legislature.

Our energy options are being restricted. The PUC has now removed coal as an option. So we're really being left with natural gas as the only source that we have for reliable power 24 hours a day. And gas prices, as we know, have been going up. And also California, many people are not supporting liquified natural gas terminals, which would bring in more natural gas for low supplies. So in my opinion, based on that California needs to be considering returning to nuclear power, as having that as an option.

I am very concerned with the current energy strategy that we have right now for long-term. I believe that if we continue down the path we are right now in terms of the options we have we're going to have blackouts again and another energy crisis. I don't know when it will happen but I believe it will happen. And I think the risk of that to the Californian's is more than the risk of building new nuclear plants.

But right now, based on the legislators' feelings, they feel it's the other way around. But I am optimistic that our legislature will observe the changes that are going on around the world and in the US, especially in other states, and hopefully that they'll change their past positions on new nuclear power plants. And I would support any efforts that the California Energy Commission could take to educate our legislature on clean and safe nuclear energy.

I want to thank you for your time today. I think this workshop is excellent. I'd like to see it every two years. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you very much. Susan Swift. (No response). She's left I guess. David Weisman. (No response). Kristin Zaitz.

MS. ZAITZ: Hi, I'm Kristin Zaitz. I am

also a member of the Young Generation in Nuclear. Who would have known that two of us would go in a row. But anyway I want to thank the Commission for the opportunity to be a part of the process. I'll keep my comments very brief.

I just wanted to say that I am one of the many Californians that are interested in our energy future. And the Young Generation in Nuclear obviously supports nuclear power. We feel that it is clean, safe and reliable.

I had the opportunity to go to our national conference, it was held in Florida this year, and it was really exciting to see the rest of the country ramping up with new nuclear, although it was a little bittersweet for us California representatives. We're hopeful in the future that we'll also feel that excitement here in California. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Robert Williams.

MR. WILLIAMS: Thank you. I spoke to you Monday. I'll try to be as brief as possible but I have worked in this area for 40 years on everything from the IRG report. I've worked with luminaries the likes of Fermi, Floyd Culler, Chauncey Starr, Milt Levinson, so let me, I'll mail you a bio.

PRESIDING MEMBER PFANNENSTIEL: Mr. Williams your comments from Monday are in the record.

MR. WILLIAMS: I understand, and I don't intend to repeat them. Jack Keenan asked, what could this Commission do that would assist him in his search for new generation. I believe that was Mr. Geesman's question. I have a more direct answer than Jack Keenan gave. It's to eliminate the two paragraphs in the Warren-Alquist Act that require this demonstration of reprocessing and require the demonstration of waste disposal.

As I have sat here today there have been five or six different ways of explaining that neither reprocessing nor waste disposal are required for the safe operation of nuclear plants. And we see a number of states in the United States willing to proceed on that basis. I think Joe Turnage's explanation of that point was very well taken.

So from my perspective let me just remind you that when the waste confidence proceeding was held there were two preprocessing plants in the United States that still had a chance of operating, the Barnwell plant and the Exxon plant. There were three plants worldwide that would be damned if the United States came in the waste confidence proceeding and said, you can only go with spent fuel storage.

Now that the dust has cleared we see that there is no need to proceed with reprocessing until it's justified for using the fissile material in breeder reactors, and there is no need to proceed precipitously with spent fuel disposal. So that argument by itself would be a major contribution and it would stimulate a debate in the legislature. I have no belief that you would not get criticism and the report would not be a big lightning rod. But you would do a major public service if you would have the courage to do that.

The other thing you could do is go back to the 2005 report and look at each of the places where it had something positive to say about nuclear power, and then look at this present executive summary, which has essentially nothing positive to say about nuclear power. I would commend you to do that. And I will write you a longer letter to transmit the rest of my strongly held beliefs. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Edwin Sayre.

MR. SAYRE: I'm Edwin Sayre, PE. I just wanted to emphasize what Mary Quillian said today about standardization. I have helped design and build nuclear plants around the world, to help upgrade the nuclear plants and to help maintain those nuclear plants. And I'll tell you this much right now, if you could really push equalization in the new plants that you're going to build in California you can do a big job in cutting the costs and improving the quality.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Tom McClean.

MR. McCLEAN: Good afternoon Madame Chair and Commissioners. My name is Tom McClean and I am a member of the Fresno Nuclear Energy Group. I want to thank you for putting on this two-day workshop. Had I come here with any doubts that what we're doing in Fresno is the right thing to do, this workshop has erased all those doubts.

For those of you who do not know what we're about down in Fresno, we are attempting to bring safe, environmentally friendly, economical and sustainable power to the city of Fresno. Specifically we are looking at nuclear power. And to that end we have signed a letter of intent with a major power company to do just that.

There are a few things that I heard here today and on Monday and a few things that I have not heard and I want to be specific about that. First of all, none of the presenters here have stated that they are opposed to building new, nuclear facilities in the state of California.

Some have brought up legitimate concerns regarding the transportation of the byproducts of these nuclear plants and where the permanent storage of these wastes should be located. All presenters who spoke on the subject agree that deep, geological disposal is a proven means of storing these byproducts, or waste as some of you call it.

The disagreement comes regarding the geographical location of the site, rather than the methodology. It was interesting to note that Allison Macfarlane agreed with the technical solution to the long-term storage but does not agree with the DOE on the assessment of Yucca

Mountain. In fact, she stated that she knew of several sites that would be appropriate for this but did not mention them because of the political sensitivities in those areas back east.

We have heard expert statements from those who live in the industry and those who study it that dry cask storage is a very safe and effective means of storage for the next 60 to 100 years. Dry cask storage would provide the cushion of time needed to satisfy not only the placement of an acceptable, long-term depository but would also satisfy the requirements needed to lift the moratorium in California.

We should remember that it is the methodology that needs to be proven and not the site itself. Transportation and site location are logistical and security issues that can be and must be addressed.

In conclusion I would like to say that the moratorium was established not as a wall to block new nuclear construction but as a gate that would be opened when the conditions set forth in that moratorium are met. There is now conclusive evidence that those conditions have been met and that the moratorium should indeed be lifted.

What we, the Fresno Nuclear Energy Group are asking for is a report from this Commission be based on fact and truth rather than on political expediency. I am encouraged that this will be the case based on the forthright questions asked by the Commissioners and the open forum that you have provided us. And I would like to thank you for your time and consideration.

PRESIDING MEMBER PFANNENSTIEL: Thank you. John Hutson.

MR. HUTSON: I've just got about 45 minutes but I'm going to pass because I spoke yesterday. (Laughter). You know, everybody is in a big hurry. But thanks very much. Let's think about energy independence. And thank you for having us here.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Bruce Marlow.

MR. MARLOW: Bruce Marlow with the AREVA Corporation, and also a Californian since 1955. This is my thirty-fifth year in the nuclear power industry and collectively I have been exposed to more radiation than everybody in this room times ten. And I'm 52 years old and I have three, healthy sons so I'm a testimony that it is not as bad as people make it out to be. (Laughter). And obviously a little bit nervous here.

So a couple of things I'd like to fill in the gaps with. One is that I'd like to talk about Olkiluoto and all the issues. But I think about ten times we talked about why costs indeed will be resolved in America with standardization.

And importantly we talked a bit about the lack of people that will help run these plants and build these plants. AREVA is spending a few million dollars every year to help bring on educated people. We have AREVA University. We're working with high schools and colleges throughout Virginia where my home base is.

AREVA itself has 61,000 employees worldwide, 41 manufacturing facilities and over 100 offices. And we continue to grow and we are not the only player in the industry. Worldwide there is going to be a lot of nuclear power plants manufactured.

In America we're looking at manufacturing some components right now in Southern Indiana at the old BWXT facility and we're starting to bring on manufacturing in America so we'll be providing jobs. It won't all be going off-campus down the road, it will actually be in America as we continue to grow the industry and provide more jobs.

And bring on a forging plant, as an example. That would be a -- If you have a forging plant today and you want to make it nuclear, $200 million and five years and you can bring that into a nuclear component facility.

Another thing that is interesting to note. And I go to a lot of industry conferences and meetings. I could tell you that there's probably somewhere in the neighborhood of a dozen every week, 52 weeks a year, of people getting in a room like this and hammering through the technical issues relative to nuclear power. I mean, it goes on at every level from security to engineering. It is not taken lightly, these people are very professional.

Like earlier, it's not a Homer Simpson organization and Binky the fish doesn't show up. We don't have three-eyed frogs or four-armed babies. It doesn't happen that way.

And I would encourage you to maybe meet with Dr. Dale Klein, the new lead at the NRC, and he has quite a program going on. I listened to him yesterday down in Southern California. He plans on having 1200 new people in his organization by 2009. He's a pretty sharp guy and quite a nice leader. He's only been in there a short period of time so I think you're going to see a lot of changes. And I think the concern about the NRC raised earlier is going to be handled quite nicely.

Let's see here. Relative to ordering a nuclear plant. There is a large surge going on worldwide. So if you were to order a plant today. Let's say the State of California could get it wrapped around today, we'd like a nuclear plant and build it as quick as you can. If you ordered it today you could bring that power on-line in 2018. If you wait two years you'll bring that power on-line in 2028. If you wait four years it will be in the 2030s. And the reason for that is because you'll be waiting for components and people to come and build it. So you really have to think long-term.

Relative to that I have a couple of concepts that I think are important to consider. Is that we encourage people to site a nuclear plant, look at doing a combined operating license at the right location. So that we can in parallel to discussing what to do with the California moratorium, also preserve the right on that privilege to actually have a nuclear plant in California if it's decided by the people of California to have such a thing. And to do that you'd have to allow for some recovery for the people making that investment. Some are in the neighborhood of 80 to 100 million dollars of recovery would be required if, in fact the plant never got built because the State of California chose not to.

And relative to the moratorium. We don't have to eliminate it. Because as soon as that debate happens, everybody that is anti-nuclear is going to say we're going to build them on, you know, Angel Island and Death Valley and we're going to build them in Yosemite. And we'll to through this huge debate about the water and the ocean.

I suggest that there are some wonderful sweet spots in the state of California that are seismically acceptable that you could build a nuclear power plant where the people in the town, like Fresno, would like to have it there for their economic benefit and also the benefit of the state of California. And that you might be able to modify that moratorium graphically as opposed to eliminating it completely. That protects the illustrious coastline and all the special places in California by allowing people to maybe have the economic benefits and power to California.

And I guess I'll say one other thing. I'd like to open up an invitation. We do these frequently. We take people on a tour in France. You can see Olkiluoto, La Hague, the reprocessing facility that for some reason everybody says does not work and is a waste of time but we continue to operate it in France. And the Japanese built a multi-billion dollar one for themselves I guess because it doesn't work but they built it anyway.

So fundamentally we can look at La Hague, we can look at manufacturing the components for nuclear plants and we can see a power plant under construction. I'd open up an invitation to the California Energy Commission, the California Public Utilities Commission, some legislators and some key stakeholders and we'd like to put that together this fall for you folks. And I'll get some information to you through our connections in writing on what that tour might look like and I think we can make that happen.

And then lastly I really am disturbed by the concept that somehow nuclear fuel that has been used is waste. If there is anything I could do before I get out of the nuclear industry is to have that W word eliminated. We used to call aluminum cans and plastic bottles garbage. We threw them in a -- everybody threw it all in one container. And then somebody got smart and said hey, there's some good properties in that, in that product. Well fundamentally spent fuel has a lot of energy in it and it's not garbage by any means.

And I know that myself I believe in the future generations of America. And I believe that the things we think that are insurmountable today will be handled in the future by the educated children that we're all educating that we brought into life. And I think we need to put some faith into them.

Whether it's fast reactors, I don't know what that product will be. But those energy canisters covered in concrete are going to be valuable assets to future generations in some form. And the reason I know that is because today's college kids will have seven jobs in their lifetime, all right. And five of those seven jobs aren't even created yet today.

We're in a fast-paced world. Technology is moving rapidly. We've done a lot just in the last 100 years. Imagine what that would be times two in the next 100 years. Those canisters of unused fuel are going to be very valuable so we need to be smart about what we do with them because our future generations are going to count on that for energy. And the world will run on that energy. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Bryce Johnson.

MR. JOHNSON: I am a retired nuclear engineer and I would like to refute the most refutable statement made by our last speaker from NRDC. He made the statement that there has been no successful fast reactor built in the world. I would like to beg to differ with that. The Russian Navy ran a significant portion of their nuclear submarines on lead-cooled fast reactors for a number of years.

The United States has built three very successful sodium-cooled fast reactors, EBR-1, EBR-2 and the FFTF, Fast Flux Test Facility. I think any member of the nuclear fraternity would regard EBR-2 as the most successful reactor that has ever been built in the world. It operated successfully for 30 years or more, it completed all its missions successfully, and it even demonstrated its ability to shut itself down safely from a deliberately-induced power excursion without any operator intervention whatsoever. That's all.

DR. COCHRAN: May I respond to that, please?

PRESIDING MEMBER PFANNENSTIEL: Certainly.

DR. COCHRAN: I don't recall my precise words but I said half of the fast reactors had failed, not all of them. And you can do that analysis by decade or by country. But by the way, EBR-1 had a 40 percent core melt. Fermi-1, which was a commercial size reactor, about the size of EBR-2, had a partial core melt.

So in the US we had Clementine, the first one with a liquid plutonium core, had problems. EBR-1 had problems. EBR-2 was successful. C-4 was successful. Clint River was cancelled. And so forth.

The Soviet fast reactor fleet. Fast reactors were put in their alpha submarines and that was an unsuccessful technology. And you don't see any fast reactors, any lithium-bismuth cooled fast reactors in the Russian Navy or even in the Soviet Navy after they pulled all their alpha submarines. So it was not successful in the Russian Navy.

But just half of them failed, not all of them.

PRESIDING MEMBER PFANNENSTIEL: Steffen Kammler.

MR. KAMMLER: My name is Steffen Kammler, I am the CEO of City Solar. I came from Germany to meet Commissioner Geesman at 4:30 today. (Laughter).

ASSOCIATE MEMBER GEESMAN: We're still going to have that meeting.

MR. KAMMLER: And I thought before I miss you I just try to mention some things out of our side. Facing these wonderful I think kids' pictures I want to -- yeah, tell you that the fact, remind you of the fact of the biggest, ever-known nuclear reactor. And guess, it's the sun.

The sun is rising since four billion years. Every day and it is coming again the next day. And scientists say the sun will rise another four billion years.

The good thing is the sun brings the energy to the earth since four billion years free, without sending a bill, free without any lines and pipes, to everyone, to every species which wants to use it. But this is also the bad thing because nobody has a chance to send a bill. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you. I believe we have one person on the phone who would like to make a comment, Marilyn Brown.

MR. GAZZOLO: She was disconnected.

PRESIDING MEMBER PFANNENSTIEL: No? Okay. Is there anybody else who would like to make a comment?

MS. WHITE: Commissioner, for the record, I do want to bring something to the Committee's attention.

Over the last several days I have received several e-mails regarding the topic of these two workshops. And in particular I am not going to be able to read all of them but I did want to share with you the gist of the e-mails.

There is great concern voiced in these e-mails, particularly about the storage issues that have been discussed so no need to rehash that. There is also concern about costs and other things.

These e-mails have all been docketed. They will be a part of the record. The questions that are raised in them will be considered by the team in revising the status report.

PRESIDING MEMBER PFANNENSTIEL: Thank you, Lorraine.

Any other comments? Hearing none we'll be adjourned.

(Whereupon, at 6:25 p.m., the Committee workshop was adjourned.)

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CERTIFICATE OF REPORTER

I, JOHN COTA, an Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing California Energy Commission Committee Workshop; that it was thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said workshop, nor in any way interested in outcome of said workshop.

IN WITNESS WHEREOF, I have hereunto set my hand this 23rd day of July, 2007.